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ABSTRACT

A field experiment investigated the use of interactive cable television to deliver in-service instruction to elementary school teachers. Fifteen schools in Rockford, Illinois, were designated as controls, 12 were equipped for one-way television, and 14 were set up for two-way communication. A consultative relationship with teachers was established through the Client-Centered Production System (CCPS), which provided for teacher input via interviews, group meetings, and a committee which worked with investigators in the selection of relevant topics and design of the programs to be produced. In interviews conducted after the showing of the eight shows, 35 percent of the teachers in the control schools reported that they had learned new teaching ideas during the year, as compared with 53 percent in the one-way communication schools and 69 percent of those with two-way communication. On the basis of these findings and cost/benefit analyses, it was concluded that the project delivered a greater variety of teaching innovations than could be presented in an equivalent amount of time by conventional means, and at about the same cost. Limitations of the experimental design are discussed, as well as implications of the findings for policy decisions. Supporting materials appended include synopses of the programs and copies of interview questionnaires. (LLS)

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TELECOMMUNICATION AND INNOVATION
IN THE WORKPLACE

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Ann Arbor

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TABLE OF CONTENTS

Page

Acknowledgments i

Introduction ii

Chapter 1
TECHNOLOGY FOR INTERACTIVE TELEVISION

- The interactive plant I-1
- Minicomputer and headend video systems I-4
- System software I-6

Chapter 2
MESSAGES: CABLE PROGRAM PRODUCTION AND DELIVERY

- Needs assessment II-1
- Program design and scripting II-11
- Program production II-16
- A program opportunity that developed late II-17
- Promoting in-service on cable II-19
- Delivering in-service II-22
- Cost analysis for producing and delivering programs II-24
- Program costs II-26
- Added cost of interactive service II-26

Chapter 3
MEASURING EFFECTS: EXPERIMENTAL DESIGN AND FINDINGS

- Experimental design III-2
- The interview III-3
- Major experimental outcome III-4
- Units of observation III-8
- Basic experimental effects III-11
- A check for contamination from conventional in-service III-13
- Persistence of effects III-15
- Range of experimental effects III-16
- A liability from telecommunication? III-20
- Added value of interactive experience III-23
- Social structure analysis III-24
- Viewing frequency III-31
- Social context of viewing III-36
- Perceptions of others' viewing III-38
- Offers of supplementary teaching aids III-39
- A classroom effect from cabled in-service III-45
- Learning from in-service on cable III-48

Chapter 4
CONTINUED USE

- The teachers' production workshop IV-4
- Arranging the means for continued system use IV-7

Chapter 5
FINDINGS FOR POLICY DECISIONS: COST/BENEFIT ANALYSIS

- Conclusion V-4

TABLE OF CONTENTS (continued)

Page

Appendix A
PROGRAM SYSNOPSES

- Videotape Synopses A-1
- Metrics For You: Temperature and Length A-2
- Metrics For You: Volume and Weight A-6
- Classroom Ideas For Teaching Measurement and Metrics A-7
- Classroom Ideas Using Creative Dramatics A-12
- Classroom Ideas Using Creative Writing A-14
- Classroom Ideas For Developing the Students' Listening Skills A-16
- Classroom Ideas For Language Experience A-18
- How to Do a Science Fair Project A-21
- Spelling A-22

Appendix B

QUESTIONNAIRE B-1

Appendix C
PERCEIVED PROGRAM SERVICES

- Reasons for viewing and not viewing C-2

Appendix D

CHANGES IN COMPLEMENTARITY BETWEEN PRINCIPALS AND TEACHERS IN INNOVATIVENESS D-1

Appendix E

DRAFT OF CONTRACTS FOR NEGOTIATED CONTINUATION OF INTERACTIVE CABLE SERVICES E-1

Attachment A
MICHIGAN STATE UNIVERSITY NSF-ROCKFORD TWO-WAY EQUIPMENT

Attachment B
UNIVERSITY OF MICHIGAN NSF-ROCKFORD TWO-WAY EQUIPMENT

References

LOCATION OF TABLES AND FIGURES

Following page...

TABLE 2-1 — II-10
Costs for Needs Assessment

TABLE 2-2 — II-15
Costs for Television Program Design and Scripting

TABLE 2-3 — II-18
Costs for Television Program Production

TABLE 2-4 — II-21
Costs for Service Promotion

TABLE 2-5 — II-22
Costs for Service Delivery

TABLE 2-6 — II-26
Summary of Costs

FIGURE 3-1 — III-10
Average Number of Programs Viewed in Experimental Schools

TABLE 3-1 — III-11
Mean Number of Teaching Ideas per School Immediately Following Experimental Period

TABLE 3-2 — III-12
Buildings Grouped According to Mean Number of New Teaching Ideas, Immediately Following Experimental Period

TABLE 3-3 — III-16
Mean Number of Teaching Ideas per School During Autumn Following Experimental Period

TABLE 3-4 — III-18
Mentions of Different Teaching Ideas, Among Teachers with at Least One Response

TABLE 3-5 — III-18
Tests for Telecommunication Effects, Separately by Categories of New Teaching Ideas

TABLE 3-6 — III-19
Average Percentages of Teachers with at Least One Mention of Televised Ideas

TABLE 3-7 — III-24
Correlations Between Number of Programs Viewed and New Teaching Ideas

FIGURE 3-2 — III-27
Distribution of School Norm Diversity

LOCATION OF TABLES AND FIGURES (continued)

Following page...

FIGURE 3-3 III-28
Average Talking Links Reported

TABLE 3-8 III-28
Rank Correlations Between Social Structure and Number of Teaching Ideas

FIGURE 3-4 III-32
Individual Program Viewing

FIGURE 3-5 III-34
Cumulative Program Viewing

TABLE 3-9 III-37
Group Origins of Social Viewing Contexts

FIGURE 3-6 III-42
Requests for Free Materials Accompanying Programs

TABLE 3-10 III-47
Median Number of Science Projects

TABLE 3-11 III-53
Mean Residuals for Metric Knowledge Based on Difficult Questions by Experimental Treatment (Values are standard scores)

TABLE 5-1 V-3
Proportional Increments in Benefits, Comparing Control to One-Way, and One-Way to Interactive Conditions

FIGURE 1 D-2
Correlations Between Principals and Teachers in Number of New Ideas

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Michigan's field experiment could not have been brought to successful conclusion without contributions by our former colleague, F. Gerald Kline. His thinking and hard work shaped all phases, especially technical mastery of the interactive system. He left to assume the directorship of Minnesota's School of Journalism and Mass Communication late in the project.

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Graduate students in the Mass Communication Research Program were imaginative and unbelievably tireless in their contributions. Kathy Kwiatek managed project operations at several crucial stages. Susan Evans executed much of the research design and performed interactive programming chores. Marianne Berry helped during program production, as did Eric Fredin, who also contributed important concepts to the analysis of data. Jean-Richard Cojuc assembled important materials for the report and helped in data reduction, as did Velma Handlin.

Introduction

A hard-headed antidote to fanciful designs for wired cities can be found in the two-way cable experiments supported by the National Science Foundation. The University of Michigan's study (also funded by the National Institute of Education) was the last to receive support. Adapting the design authored by Michigan State University (see Baldwin, et al., 1978), the Michigan team applied MSU's system architecture and computer software toward helping school teachers learn new classroom ideas.

An important goal in designing the experiment was to find out whether interactive cable television can be used to increase work productivity. This curiosity underlies MSU's firefighter study and explains Michigan's interest in public school teachers. The bureaucratic structure of school systems isolates teachers from all but their closest peers and frequently impedes the flow of innovations. Communication of ideas among buildings is uneven; the spread of new teaching practices from outside a system to internal segments is uncertain and difficult.

Schools have recognized these barriers to change. A formalized process of "in-service training," has been one response, scheduling institutes and workshops to bring teachers together and expose them to innovations in teaching methods. In-service training has serious drawbacks, however. Institutes for a large school system can be planned only occasionally, and too many sessions are often packed into a day or less. If hundreds of teachers take part, each individual's exposure to information is fleeting and haphazard. In-service training can also be expensive. The cost of a day's workshop intended to reach all elementary teachers in a moderately large system (50 to 60 buildings) can exceed $50,000 in salary alone.

The Michigan team reasoned that interactive cable could be programmed with in-service material containing the flavor of question-and-answer sessions that sometimes accompany institutes and workshops. Comparing the results of conventional in-service training with interactive and one-way cable would illuminate any advantages of the interactive technology and of television generally.

The Rockford, Illinois elementary schools were selected for the project. Our friends at Michigan State had already determined that Rockford Cablevision afforded a technical plant with unusual advantages for mounting interactive service. Contacts with public school officials disclosed a willingness to cooperate in testing the worth of cable for improving the prospects for professionals' work performance.

Teachers volunteered their viewing in our cable experiment. They were not coerced nor compensated for extra time they might spend. Their union agreement provided no punishments for non-viewing and no tangible rewards for taking part. Within these constraints the Michigan team forecast that the interactive capacity could yield at least three benefits compared to one-way cable television.

The most obvious is that anticipation of responding directly to programs should induce greater attention to the material. Using the terminal should change viewing from a passive to a more active process. The Michigan team hoped this shift would occur even though viewers' use of the terminal would not be monitored by supervisors as in MSU's firefighter study.

Second, interaction might confer its own reinforcements, regardless of questions asked and responses elicited. Despite stereotyping and limits on individuality, viewer responses might confer a sense of power and control over a machine system.

We pinned our greatest hopes for interaction on a third potential benefit. It derives from social comparison, a common function served by communication. The exchange of messages permits people to form judgments about their own

11

abilities and opinions through reference to the attributes others disclose by what they say, intone, write, or display bodily. (For theoretical statements and relevant empirical evidence, see Chaffee and McLeod, 1973; Festinger, 1954; and Latane, 1966.) Interactive technology is well suited for enhancing the social comparison functions of conventional television. To familiar opportunities for comparison between viewer and performer and among co-viewers, interaction adds comparison between viewer and reference groups, such as other people with similar work demands.

Unfortunately, a field experiment offers too crude a research environment to distinguish among these and other behavioral advantages that could be afforded by two-way television. We must look to controlled laboratory studies for detailed explanations.

Overview of the report.

Our evaluation of interactive telecommunication can be told in five parts. We tested a technology in Rockford. For this we produced messages whose effects on professional productivity could be observed. We gauged prospects for continued use of the technology to deliver additional messages about in-service to teachers. Finally, we identified findings that contain implications for policy decisions.

For the most part our technology had been invented by colleagues at Michigan State University in collaboration with senior engineering staff at Rockford Cablevision. We will review their work briefly, noting where our project needs required modification of their system's interactive capability.

Our messages consisted, finally, of eight television programs dealing with topics important to elementary classroom teachers. We developed a Client-Centered Production System (CCPS) in order to craft these programs in relevant and appealing ways. CCPS is sufficiently novel to warrant detailed accounting of its organizational features and direct costs. These costs are especially important to an informed judgment about whether conventional and interactive cable present society with attractive benefits. While delivery costs in mass communication attributable to technology change dramatically with the invention of new devices and manufacture of them in volume, the expense of fashioning messages remains relatively stable. People must come together with knowledge about content and talents at expressing it in words and pictures. Message production is labor intensive.

Assessment of effects required a field experimental design sensitive enough to separate message outcomes from the most obvious contaminations that could be isolated. Effects will be described that bear on the adoption of interactive cable and on the use of conventional television for improving work productivity.

The last part of our story concerns continued use of cable for in-service--and perhaps other applications in the workplace. Continuation beyond the sheltered period of federal support depends on operating costs of a technology and production costs for more messages. More importantly, it depends on whether people already lodged in organizations see personal rewards to be achieved in stimulating use of cable. Communication systems do not speak for themselves, asserting obvious benefits to users. They are "sold" within organizations by people hoping to gain some advantage in promoting their use.

Chapter 1

TECHNOLOGY FOR INTERACTIVE TELEVISION

The University of Michigan project with teachers was approved for funding after the National Science Foundation had authorized an experiment to deliver training to firefighters in Rockford. This undertaking by Michigan State University has been described in three volumes of reports.* (Baldwin, et al., 1978) A major share of their effort was devoted: 1) to designing a digital return communication system using a single cable; 2) to developing a switching system that would limit noise and signal ingress, and 3) to writing mini-computer system software to control two-way cable and display appropriate feedback to viewers. The University of Michigan group adapted this technology to the special institutional demands of its users.

The interactive plant.

The system represents a combination of complex hardware and software. The hardware necessary to support interactive programs begins with a viable two-way cable television system, to which is added minicomputer-controlled video origination equipment. The software must coordinate the processing of a series of lessons, including control of all necessary video equipment and monitoring of viewers' interactive responses in real time. The hardware and software configurations for the Rockford experiments were designed to accommodate the simultaneous administration of two different lessons over separate video channels, although only one program was run at a time.

The Michigan State University-Rockford digital-return, two-way cable communication system in the firefighter training experiment used response pads designed by Coaxial Scientific Corporation at a small-quantity cost of $150 each. Our project used the same devices. These terminals are much lower in cost than the $300 terminals used in most other systems. They are modified standard cable television channel converters (Jerrold SX-2). Each standard converter has 12 push-button switches and a three-position band switch,

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*The section of this report describing interactive technology is based on final reports to the National Science Foundation by Baldwin, *et al*. We are grateful for their permission to excerpt those materials.

normally used for selecting up to 35 cable channels. In addition, the adapted converter has a four-position response mode switch that can be set to the normal channel selection mode, or to one of three designated response channels.

When a response channel is selected, the 12 push-button switches and band switch function as an alphanumeric keyboard, whose symbols may be arbitrarily assigned (e.g., a template may be placed over the keyboard to provide specific operation instructions). The terminal's transmitter continuously sends a 16-bit data word to the computer-controlled receiver located at the headend. This data word reports the status of the keyboard and function switches, as well as other pertinent information. When a user wishes to transmit an upstream response, he or she depresses the corresponding push-button switch and then depresses the response transmit button. This sets a response bit in the data word for a short time, during which the response indicator light is illuminated.

In order to accommodate a large number of terminals, the cable network is accessed by the technique known as area multiplexing. The network is divided into a number of primary sectors, each further divided into secondary sectors. The upstream signal from each primary and secondary sector is passed by digitally controlled, in-line code operated switches (COSs). At any one time, the computer can scan a secondary sector of up to 200 terminals, addressed by selecting a combination of one primary and one secondary switch. Each terminal within a secondary sector has its own unique frequency. The computer-controlled receiver tunes in on this frequency in order to read the data word from the terminal.

The minicomputer controlling the system is a General Automation SPC-16/65 with 64K 16-bit word memory; real time operating system; 10 megaword disk storage; and necessary peripheral equipment, controllers and interfaces. An essential component in the headend hardware configuration is a timecode generator/reader, used to synchronize videotaped lessons with their corresponding computer interactions. Shintron 367 timecode unit communicates with the computer via a video interface module designed and built at Michigan State University's Artificial Language Laboratory. For computer-generated text, the system uses a character generator which provides four different software-selectable color backgrounds. The computer also controls a video switch which selects either the video-cassette recorder/player or the character generator as the source of the outgoing video signal. Terminal data are collected using a transmitter and scanning receiver designed by Coaxial Scientific Corporation.

The Rockford Cablevision plant is a four quadrant, single, trunk line cable system. The upstream response subsystem consists of control devices at the cable system headend, primary code operated switches (P-COS), secondary code operated switches (S-COS), response terminals and test end-of-line oscillators (ELO). The two COS's generate identification signals which are used to confirm their activation. These signals are transmitted to the cable system headend along with an FSK-modulated terminal signal and the ELO signal.

The minicomputer sequentially interrogates the response terminals in the field by (1) transmitting coded FSK (frequency shift keyed) signals at 112 MHz to addressable receivers located in the P-COSs and S-COSs, which select quadrant and amplifier, and (2) by tuning one-by-one through the various terminal FSK signals, identifying each terminal by its unique combination of COS, ELO and terminal frequencies.

Greater detail about the cable system's technology and performance can be gleaned from Chapter 6 of MSU's report to the National Science Foundation. Our project with teachers experienced only one equipment malfunction in eight months of service delivery. During an unusually cold spell in January, 1978, signals to and from individual schools phased on and off in a perplexing way. Field engineers from Rockford Cablevision diagnosed the problem, installed a missing capacitor in each COS, and returned the system to service after a 13-day period of uncertain program delivery. COSs had been coming on and off line as warming sunlight or shadows fell on the equipment, which was exposed to weather.

Routine computer maintenance and headend checks on the system were sufficient to maintain other portions of the plant in reliable working condition.

Minicomputer and headend video systems.

The minicomputer system consists of the minicomputer and various peripheral devices and controllers. The control device for the system is a Hazeltine 2000 CRT terminal connected to the system using a 9600 baud line. The ASR-33 Teletype unit is used primarily for system maintenance but can also be used as a backup system control device.

The special controllers necessary to connect the scanning receiver and COS transmitter were built and supplied by Coaxial Scientific Corporation. The interface between the headend video equipment and the minicomputer are standard General Automation general purpose input/output controllers.

Video equipment at the cable system headend includes two Sony VO-2600 VCRs; two character generators (Telemation and 3M) for alphanumeric message display; two Shintron 367 timecode units for recording and reading timecodes on the videotapes; and the Michigan State University Timecode Interface and Video Switcher Controller which enables the minicomputer to control and receive timecode data from the VCRs, as well as to control all VCR functions and the outgoing video signal.

The Michigan State University Timecode Interface and Video Switcher provides the necessary link between minicomputer and video equipment which makes the two-way system completely computerized. It enables synchronization of the videotape and computer operations for the interactive segments.

The timing operation begins by pre-recording the SMPTE timecode information on the first audio track of each videotape using the timecode reader/generator. Hours, minutes, seconds and frames of tape time are digitally encoded for each frame of the videotape. During program delivery the timecode track of the videotape is played back and decoded by the timecode reader, and presented to the interface unit in multiplexed form. The interface unit demultiplexes the data and makes them available to the minicomputer. The minicomputer is pre-programmed with times at which interactive items are to occur. The lesson processor program which coordinates the lesson administration continuously checks the running timecode supplied by the Interface against the pre-programmed interactive codes. When they are equal, the processor executes a routine for interactions.

A key feature of interactive items is instant feedback provided by the computer in the form of character-generated messages. In order to provide this display, the videotape must be paused, and the video output line switched to the character generator. The Interface-Video Switcher provides this capability by sending signals to the VCR through an external IOS (General Automation's Input/Output System) driver. In this manner, signals of forward, stop, rewind, fast forward, pause, VCR video source and character-generated video source can be sent to the VCR by the minicomputer.

A more technical discussion of the interface may be found in vol. II of MSU's report.

System software.

The software resident on the minicomputer, written in FORTRAN and General Automation assembler CAP-16, supports not only the administration of interactive programs, but provides complete facilities for preparing computer interaction scripts and files, and for maintaining a working image of the cable network.

LEAF (Language for Educators and Firefighters) is a computer language developed especially for use in the Michigan State University-Rockford instructional system. It is highly user-oriented and allows the program producer to convey information about interactive items in the lesson to the LEAF compiler.

A LEAF program consists of two sections in Michigan's application: Initialization and Configuration. The LEAF format is designed so that the Configuration section parallels the audio-video production script for the corresponding program.

The Initialization Section consists of a list of statements which contain the name of the lesson, number of interactive items in a lesson, the date, lesson author, equipment used during the lesson and whether the interactive item text will be displayed by the character generator. A maximum of 14 allowable equipment codes is permitted. The presence of a GENERATE statement is a signal to the LEAF compiler to store question and answer texts as a record for that program in the TEXT file. All information obtained in the Initialization section for a particular lesson is stored by LEAF as a record in the IDENT file.

The Configuration Section contains an ITEM BLOCK for each interactive question in the lesson, giving the ordinal of the current item, type of question (multiple choice, ranking, dichotomy, etc.), color for the background of any character-generated text, number of foils and (if appropriate) the correct answer. If the text of each item is to be displayed by the character generator, the ITEM BLOCK also includes HEAD and FOIL statements, which give the text for each item, stored in the TEXT file. Each HEAD and FOIL can occupy two 30-character lines, with a maximum TEXT file size for each lesson of five disk sectors.

The final configuration section command is ECHO, an option which allows for immediate response feedback after an interaction has occurred. ECHO information displays via the character generator a breakdown of student responses to each item in various formats: for each foil, the number of percentage of respondents, or if desired, a listing of their ID codes.

Once the six system files have been established, system information about the lesson is completed. The lesson may be shown at any time by inputting the lesson name and number to the lesson processor program $LESSON. The program accesses all of the stored data and manages all interactions, including starting and stopping the VCR, transferring video output to the character generator, scanning the terminals and providing instant response feedback. The processor program also updates the student RECORD file.

The log-in procedure, during which respondents enter a three-letter ID code, one letter at a time, using their response terminals, is one of the more complicated routines of the lesson processor in terms of hardware/software interaction. The subroutine LOGIN, which calls eight other subroutines during execution, controls the operation, which first writes a log-in message to respondents on the character generator and sets a five-minute limit for the procedure to be completed. The program then uses NETWORK file information to set scanning flags for all terminals in the system to be scanned.

The scanning routines begin by addressing the primary and secondary COSs controlling each network sector, by sending a signal at the correct frequency to open the corresponding switches. The individual terminals in each sector are then scanned for data, which are decoded and converted to their computer code equivalent. Appropriate signal level checks are made to insure good transmission of data.

Since the log-in procedure involves a three-letter ID, each terminal must be scanned three times to collect the full identification code. A viewer can cancel an erroneous entry and log-in again with the correct ID. Each three-letter code is checked against the master list of ID's from the teachers' RECORD file and displayed on the television screen by the character generator to confirm that the log-in has been accomplished. In addition, the routine stores the terminal number of each respondent in the attendance byte of his subrecord in the ANSWER array to indicate that the teacher is viewing.

Having completed the log-in, the lesson processor sends a forward command to the VCR, and the lesson videotape begins. At this point the processor starts checking the current time codes on the videotape with the next sequential value in the TIMECODE array. This timing sequence continues until the running timecode equals or exceeds the stored timecode value.

At each interactive point in the lesson, the processor retrieves necessary question information, such as question type, number of foils, background color and ECHO information from the ITEM file. Scanning flags are set for those terminals entered during the log-in; the program then scans those terminals for responses and stores answers in the data array ANSWER.

In its original version, LEAF could not process and display opinion response data, nor could it provide feedback according to source of input. The Michigan group secured these modifications through a contract with MSU. Teachers were enabled to see cumulative response distributions for evaluative questions and to see feedback displays formatted according to the grade level of viewers supplying response data, the schools at which they taught and other individualizing variables. Feedback of correct answers to factual questions was retained, of course.

Chapter 2

MESSAGES:
CABLE PROGRAM PRODUCTION AND DELIVERY

In several respects our process of producing in-service programs for television was more novel than the delivery technology. The Michigan group sought to maintain a consultative relationship with Rockford teachers that would insure program content relevant to their needs. A Client-Centered Production System (CCPS) was designed that may have wide applicability for similar efforts to upgrade professional job performance.

CCPS can be divided into stages of needs assessment, program design and production. Each of these phases required the investment of different combinations of staff time and other costs in order to achieve specific programming objectives. It will be helpful to review objectives and the labor necessary to attain them before turning to a final budgetary accounting. Full description of the latter is needed, of course, by anyone wishing to judge the feasibility of employing CCPS as a management plan for developing in-service training materials in other institutional settings.

Needs assessment.

Once assent to the project had been gained from the School Board, the teachers' union and key administrators, the Michigan group embarked on programming activities that would result in more than three and a half hours of edited videotape a year later. Activities were shaped at the outset by five assumptions:

1) In-service programs should serve the information priorities expressed by Rockford teachers; it was unlikely that existing films or other in-service aids could be assembled conveniently and effectively to satisfy these priorities. Our in-service tapes would have to be produced afresh.

2) The content presented through in-service on television should be expressed in the person of Rockford teachers and in their words. Demonstrations of classroom ideas should show teachers working with their students in actual school settings. Continu-

ity binding different program segments should also draw on teachers as program participants.

3) Production techniques--use of cameras, audio, lighting and editing to combine location shots with graphics and other ingredients--should be professional and lead to attractive programs. But selection of techniques should strive for economy, and especially for a level of sophistication in production that could realistically be emulated by the Rockford Schools once our research project ended.

   Eventually, we hoped to leave behind a cadre of school people trained to use television effectively for in-service, in either standard or interactive modes depending on the project's research findings and relative costs.

4) The mix of programs produced and delivered should be pertinent to the interests of teachers at several elementary grade levels. If this could not be achieved, some programs should be aimed at primary levels and others at teachers in grades four through six.

5) Programs intended for conventional, one-way delivery and for interactive presentation should differ in a single respect--the opportunity for viewers to signal responses and view feedback. This requirement was mandated by research demands that might not be present in other uses of cable for job training.

We commenced an assessment of teachers' in-service needs with these assumptions in mind. A simple, inexpensive and yet exhaustive survey of all teachers in the 28 buildings, initially designated experimental, was conducted in late spring, 1976. Two crucial questions were asked in self-administered questionnaires completed by 83 per cent of classroom staff and principals.*

One line of inquiry asked for nominations of teaching problems that deserved more adequate coverage through in-service. The second question confronted each teacher with a list of colleagues in his or her building and asked him or her to identify those "who have good ideas about teaching."

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*The questionnaire was identified as part of a University of Michigan study of teaching and was completed anonymously.

We sought nominations of teaching problems for the glimpse they would provide of the most vexing task demands in classrooms. We were rewarded with a host of ideas that defied systematic categorization. Some responses centered on subject areas like math or reading. Others concerned student behavior and peer relationships, prompted by efforts toward racial integration then commencing in the city. Some teachers focused on their own emotional or cognitive needs, asking for help in classroom management or the mastery of unfamiliar material whose understanding was instrumental to teaching effectiveness.

We did not dwell on these responses for a simple reason. The only frame of reference in which teachers could have answered our first question was confined by traditional methods of in-service. Teachers could not have visualized, literally or figuratively, how television might open different avenues for in-service; they could bring to mind only staff meetings they had frequently experienced in their buildings or "institute days" on which they trooped to a central location and dashed from one lecture to the next.

We were more interested in replies to the second question. Nominations were used to form a teachers' needs assessment committee, the first critical ingredient of our Client-Centered Production System. In almost all buildings a single teacher or pair stood out, receiving unusually high numbers of mentions from colleagues. In some schools the teachers with best ideas about their work turned out to be conservative, practicing familiar and oft-repeated patterns of classroom behavior. In other buildings nominees were innovative, even daring risk-takers.

We were unconcerned with the teaching styles and values held by peer-identified leaders. What was important was the work-related esteem they had earned in colleagues' eyes. We presumed this signified they could serve as accurate exemplars of teaching ideas respected by others in their buildings and as effective channels of communication about in-service needs between classroom teachers and our project.

The needs assessment committee comprised the most frequently cited teachers. We judged a group of twelve persons (minus inevitable absences) would constitute a productive group size; six interactive and six one-way buildings were randomly chosen and top-rated teacher in each invited to join the committee. Two persons pleaded other commitments, and alternatives were invited from their buildings.

The invitation conveyed the project's general nature and promised that few meetings would be scheduled. Participants would be paid $25 per session for meetings that began after school and ended by 5 p.m. All members were women; we estimated that three were in their 30's, four in their 40's, and the remainder in their 50's or 60's. All grade levels were represented, first through sixth.

In all, three sessions were held. At the first we explained interactive cable television and some of the applications we felt it and conventional television could have for improving staff effectiveness in a professional work setting. We described the project's duration (one full school year's program delivery) and our five assumptions about programming spelled out above. We mentioned but did not emphasize our research interests. We wanted the panel's attention focused on operational, rather than evaluative features of the project.

Most important, we established the following consulting "pact" with the committee:

> This project is budgeted to produce five separate in-service programs for television delivery. Viewing of these will be voluntary. We want you and your colleagues to tell us what these programs should be about, to recommend the people who should be asked to participate in the shows, and to guide our hand in technical decisions like program length, period of airing, sequence of airing, and the like.

We also informed the committee how it had been chosen.

After a moment's surprise at being issued a sincere and wide-ranging request for help, the committee got down to work enumerating some of the in-service topics they felt would have the greatest appeal and offer useful contributions to improved classroom performance. We allowed these discussions to continue long enough to establish interaction dynamics in the committee--to permit high and low talkers to identify themselves. We asked the group if they wanted to establish a formal structure, appointing a chairperson, or someone to take minutes, or adopt an executive committee to simplify their work. They did not, preferring that the Michigan project leader serve as their chairman.

Then we ended the first gathering before in-service programming ideas could coalesce into a firm set of proposals. In parting we said:

> You now understand your representational role and how heavily we depend on you. Please go back to your schools, describe the project, and solicit programming ideas from colleagues. We'll meet in another month, and perhaps again after that, to draw up an agenda for our production crew. We want to start program design soon and need your contributions now.

The second meeting was held four weeks later; one member had a conflict and another arrived late. All but one came with detailed notes reflecting discussions they had initiated in their buildings. We went around the table drawing out as complete a specification of programming topics as members could report. Each readily described the popularity of ideas among teachers in her building and whether or not ideas could build on earlier, conventional in-service training. Questions and comments from the committee members were frequent. This initial round of reporting took nearly 45 minutes; it was evident that some members had polled their entire building staffs individually and that others had arranged informal but comprehensive group meetings at lunch or during free periods. The committee's diligence at the tasks we had assigned impressed us.

Ensuing discussion drew all but two of the eleven committee members present into participation. By 5:40 p.m., two hours after the meeting had started, the group had completed its recommendations. In this time 37 discriminable in-service programming areas had been discussed.

One intense need was for ideas about how to manage student peer relations as racial integration took hold. After some discussion the committee (which included two blacks) decided the issues were too complex to benefit from a short television program or even a series of programs; the idea was set aside. Another popular topic dealt with classroom management, tips for how teachers could allocate their time and energies more effectively throughout the day and in preparation before class. It was set aside for lack of visual relevance that would make television a logical communication medium.

The committee sorted through remaining ideas with surprising ease. Members quickly identified metric education as the most needed area for in-service. They emphasized what they wanted in some detail: first, lessons in basic metric concepts so they would understand linear, volume and weight measurement; then some training in how to teach the system with imagination and enjoyment. The Michigan staff promised to examine how these several goals could be accomplished within the production budget outlined earlier.*

Four other topics, all in language arts, enjoyed wide appeal. These concerned expanding the use of creative writing exercises, using classroom dramatics in teaching language arts, developing sharper listening skills, and employing the "language experience" approach. We had our five programs specified and a wealth of backup ideas if preferred topics proved difficult.

Next, the group turned to suggesting participants. They acknowledged unfamiliarity with the demands of television "showmanship." But they did not hesitate to identify colleagues throughout the elementary system (in any of the 54 buildings) considered capable, inventive and poised in each subject area. Their recommendations were specific to each programming topic under consideration and not a nomination of "master teachers" thought to be accomplished in everything.

As the list of names grew and comments about each person were offered, it became apparent our roster included teachers who had led district-wide training programs or who had been part of a consulting team that had traveled to individual schools, helping with different classroom issues, before budget cuts became necessary. Failure of recent bond elections had shrunk the number of institute days and forced disbanding the consulting team, but teachers who had contributed to these efforts were remembered.

Others on the list had chaired summer workshops, again a feature of more affluent times. Some persons had played less prominent roles; they were acquaintances talented in a particular teaching area.

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*We subsequently expanded the number of programs from five to seven in order to accommodate teachers' appetite for information about metrics.

As the committee matched teacher/participants with program ideas, their preferences for program structure became visible. These preferences were not expressed explicitly, nor did the Michigan project team have the wit or skill to elicit them in a formal way. Repeatedly, however, the following kind of interchange took place:

Committee member A: Another good person in the area of listening skills is (name) at (school).

Committee member B: Yeah, you should talk to her.

Michigan project leader: What, specifically, should we ask her to contribute to a program about listening?

Committee member A: Whatever she's doing. She has good ideas.

This conversational nugget captures what we came to believe the committee and other teachers wanted. Our conviction about this grew slowly and may have been compelled by some of the programming assumptions discussed earlier.

Teachers wanted to be placed in communication with other highly regarded teachers. The audience possessed only fragmentary expectations about specific techniques or ideas esteemed teachers might show on television. It was assumed that whatever they might demonstrate would be interesting and would provoke related ideas among viewers.

Thus, in the consultative process committee members were telling us. . .

Here are some classroom demands where teachers need help;
These are our colleagues who are capable in these areas;
Put them on television demonstrating ideas that have worked
in their classes, and we are bound to learn something useful.

As the second assessment meeting drew to a close, members felt they had provided all the advice they could for the moment. The Michigan team departed with the promise that we would expand and refine the list of participants, with an eye toward the constraints and demands of television production. We also would produce major segments of a program about metric teaching ideas, edit the tape, and return to show it for the committee's evaluations and advice about subsequent productions.

At this point our narrative skips a beat. As a pilot we chose to produce portions of the third program dealing with metrics, a show illustrating classroom games and other strategies of pupil involvement reinforcing measurement concepts. Steps leading to this production, as part of our CCPS model, were no different from later productions, and we will relate those details shortly. Beforehand, we should conclude our account of needs assessment.

Once the pilot had been rough edited, we reconvened the teachers' committee for a screening. All but three members attended a session that finished its work in less than 90 minutes. We showed program excerpts including a teacher-host's introduction and several class visits at first, third and combined fifth/sixth grade levels. In each demonstration the classroom teacher explained her learning goals, and the camera captured scenes of pupils performing exercises, playing learning games, and manipulating objects that reinforced distance, weight or volume measurement. The host concluded each visit with a short interview that elicited more details about the scenes just viewed.

The program shown to our needs committee was incomplete, however. It lacked voice-over bridges between segments and interactive components. A concluding offer of free teaching materials had not been edited into the tape. Nonetheless, our committee could sense clearly how we had interpreted their expressions of in-service needs in a television language of color, motion, space and sound. They could see the kinds of teacher/participants resulting from our scripting and program design.

The needs committee was dazzled. In fact their response was enthusiastic to a fault; no amount of probing could unearth a substantive or procedural criticism helpful in guiding future productions. The effect of screening and subsequent discussion was to establish closure in teachers' minds. They had been consulted and their advice heeded with gratifying results. There was, in their judgment, nothing more they could offer. They wished us well.

In retrospect we could have benefited from further contacts with the committee as later productions were completed and opportunities for quickly assembled programming became known. While our CCPS avoided catastrophes, it could have yielded even more powerful results if the needs committee had been kept in the picture for consultation as problems arose.

But at this point formal efforts toward needs assessment ended, though consultations of a different kind persisted throughout the project and will be described in appropriate sections below. Costs for conducting this style of needs evaluation can be quickly summarized:

TABLE 2-1

COSTS FOR NEEDS ASSESSMENT

Task	Staff level and hours	Direct costs
Teacher survey to identify needs assessment committee members--design, execution and analysis	Senior project director: 8 hours Project aide: 110 hours	Printing and distributing questionnaire; coding and punching data; analysis; etc.: $770
Establish and meet with needs assessment committee	Senior project director: 35 hours Television director: 35 hours	
Compensation for needs assessment committee	Secretarial support: 7 hours	Per-meeting payments to cover time and mileage: $806

Program design and scripting.

Experience with the needs committee had illuminated the major task in designing effective and appealing in-service on television. Our job was to locate teachers who had ideas to show and could do so articulately before camera. Our Client-Centered Production approach mandated that we go about this work in an interactive manner.

The committee had given us names in the five topic areas. We visited each person at school to talk about project aims and to gain some feeling for classroom ideas the teacher thought colleagues could usefully copy from his or her methods. We inquired about other teachers who ought to be consulted or who might participate in programs.

Visits to additional nominees were scheduled and we asked them the same questions. Thus we continued testing the validity of topics the needs committee had recommended, confirming they were important to teachers. We kept asking for nominations of participants in each program area until familiar names were all we obtained.

Each visit was used to make an informal appraisal of a teacher's potential for appearing on television. Admittedly these judgments are subjective and open to some disagreement. And a 45 minute conversation between an elementary teacher in Illinois and a University of Michigan faculty member, previously unknown to each other, can yield uncertain evidence about telegenic qualities. But our talent search was not entirely hopeless.

We talked with 53 classroom teachers and 14 principals. Visits ranged from 20 minutes to more than an hour. Among candidates for participation in programming we noted both constancy and variation along dimensions of subject matter knowledgeability, self confidence and assertiveness.

Expertise and self confidence were almost uniformly high, due to our selection procedures. Only seven of the teachers visited failed to impress us that they had useful ideas about topics that brought us to them. Another two seemed discouragingly uncertain about what they knew, although we felt they had more ideas than they sensed. We dropped these persons from further consideration as program participants.

Teachers varied more in assertiveness, or how eager they were to appear on television. We refused to take a teacher's first "no" for an answer, however. If a teacher seemed knowledgeable and poised during our visit about the teaching topics under discussion, he or she was retained on our private list of possible talent. In these and other cases we sought opinions of other teachers and administrators about a person's calmness and flexibility in a confusing or tense situation, which he or she would encounter during television production on location. These inquiries, plus our reluctance to eliminate unassertive teachers, rewarded us with a number of excellent participants.

A few teachers seemed surprisingly eager to appear on television, and this made us apprehensive. In all cases but one this enthusiasm proved an asset, however.

The next step following interviews was to conduct group meetings with likely contributors to individual programs. These sessions were used to sort through potential program ingredients and discuss in-service goals that could be achieved by demonstrating the classroom ideas under consideration. If one or two potential participants were unable to attend these meetings, a teacher in the group took responsibility for going over plans by phone and conveying those persons' program contributions to others, including the Michigan project director. In this way a rough script for each show evolved containing a list of classroom activities that would be demonstrated, talent involved, in-service goals to be met, transitions or other bridges necessary, and graphics, props and other supplementary materials that would be needed.

Group meetings were also occasions for planning about two other features of television content. The most important was interactive components. We consulted extensively with teachers about the opinion and factual questions they thought most evocative. Our method for extracting these suggestions was straightforward, along the following lines:

> We've just been working on the classroom ideas you want to show others and the student activities a viewer will see. What does a teacher need to think about in judging whether or not those ideas are appropriate for use in his or her classroom? What are the factual points a viewer must grasp in order to make effective use of your ideas? When we provide feedback to interactive viewers, how should this be arranged--overall distributions, responses by grade level of teacher, responses according to school of viewer, or some other way?

Once we had drafted questions we reviewed them with the group or with individual participants. Their help was also instrumental in writing appropriate response alternatives.

The second additional feature of planning concerned free teaching materials associated with each program. Here we must spin back in our story to the needs committee. They were convinced that television would be a pale substitute for conventional in-service training unless supplemented by a familiar element of workshops and institute days. Teaching aids--like workbooks, ditto masters, study guides, and other curricular supports--are often made available to those who attend. Our committee felt these same devices would help make teaching ideas seen on television more concrete and easier to apply in day-to-day work .

We were attracted to give-aways for a different reason. Sending for them would represent a behavioral response to programming and, possibly, a sign of commitment to use the ideas we broadcast. Free materials offered a different kind of dependent variable for gauging results, one whose measurement would not be contaminated by our search for other cable system effects.

Additionally, the interactive cable system was an administratively efficient device for teachers to register their interest in supporting materials. Give-aways could be used to test another cost-effective benefit from responsive, compared to conventional telecommunication.

Starting with our early meetings, program participants were asked for suggestions about the content of give-aways. We placed restrictions on their imagination: they should propose items that were inexpensive and that would be a genuine help to teachers they knew about. The give-aways and the outcome of these offers are described more fully elsewhere. We note them here simply as another early part of our Client-Centered Production System and the consultative relationship established with program participants.

As essential participant in each program was our teacher/host. We needed this person to establish continuity, to interview other participants about their educational aims and results, to present give-aways at the end, and to achieve a number of dramatic effects. Five different hosts were used--one for the three metric shows and others for the four different language arts topics. Program design sessions were used to allocate in-service roles between classroom participants and hosts, to reach a general understanding of what these two parties would talk about before camera, and to resolve how they would relate to children taped in classroom scenes. In no instance was dialogue scripted, however. Rather, we blocked scenes, linked them in sequence, determined the content for transitions, decided the placement and content for interactive segments, and planned how the give-aways should be presented.

It should be emphasized that planning during this stage of the CCPS required us to move back and forth conceptually between identifying the desired programming elements as participants saw them and determining the technical feasibility of presenting those elements. Essential contributions were made by the television director (the head of Broadcasting Services at The University of Michigan). He joined the senior project director for the final meetings of each program's group of participants and was available for technical advice concerning production much earlier in the process. He visited taping sites before shooting scripts were closed.

In this way the logistics of final production were organized, resulting in few unwelcome surprises on shooting days. The person who would oversee the television crew had conferred with on-camera talent in advance and had established rapport with program hosts. Aspirations about program content that were technically impossible or risky had been eliminated.

Staff time used in these functions is shown in Table 2-2. A missing entry deserves comment. Teachers who worked on television planning volunteered their services after school hours, often traveling to distant buildings for meetings. Their reward was the enjoyment of doing useful things and being involved in television. Once production began, time in many participants' classes had to be replaced with substitutes, whose compensation will be duly noted. But before taping began elementary teachers squeezed a total of 216 hours in our behalf from their free time after school, lunches and planning periods during the day.

TABLE 2-2

COSTS FOR TELEVISION PROGRAM DESIGN AND SCRIPTING

Task	Staff level and hours	Direct costs
Scheduling meetings with potential participants and talent used in programming	Project aide: 26 hours	
Meetings and script planning with potential participants and talent used in programming	Senior project director: 14 hours Television director: 20 hours Project aide: 24 hours	Incidentals--local travel, etc.: $313
Technical arrangements associated with program design	Senior project director: 12 hours Television director: 4 hours Secretarial support: 22 hours	
		Fees paid to substitute teachers: $227

Program production.

Location taping of classroom scenes and host interviews was scheduled to require a minimum of crew time in the field. Five working days yielded scenes for the seven in-service shows for which the Michigan Television Center was primarily responsible. The eighth program about Science Fairs was organized and taped by Rockford Schools staff under supervision by Michigan staff and will be described separately.

A typical day's shooting began at 8 a.m. as on-camera teachers, program host, project staff and crew arrived at the first location. Scenes involving the youngest students were completed earliest in the day. Shooting moved from room to room in a building until scenes that included children were completed; introduction, transitions and wrap-ups were produced last, and crew and equipment moved to the next building where classroom ideas were to be taped. Scenes taped in a single building might contribute to one or more programs.

Basic staff, in addition to on-camera people, included the senior project director (who became producer of the shows), the director, a cameraman, two engineers (for video and sound), a lighting grip and one or two project aides whose chores included keeping production notes. Scenes were taped using an RCA TK76 portable camera and a JVC 4400 LU cassette recorder, taping onto a standard 3/4 inch U-matic type cassette. Light sets, fishpoles, ECM 50 Sony microphones, and M67 microphone mixers were transported from the University of Michigan Television Center to the taping sites.

Days on location ended between 4 and 6 p.m., depending on how many non-classroom scenes had been crowded into the latter part of the day, after children were no longer available.

Tapes were edited in Ann Arbor using a Convergence Editor ECS1 editing system and two Sony 2850 cassette recorders adapted for editing. A time base corrector Digital Video System DPS1 was used for making dubs. Voice-overs for interactive segments were also recorded in Ann Arbor. Identical sound tracks were inserted into one-way tapes along with a visual frame, "Questions to think about," to provide a visual stimulus. Of course, feedback could not be provided viewers of one-way programs.

Synopses of the seven major programs are shown in Appendix A.

A program opportunity that developed late.

During autumn of the service delivery year a number of teachers, excited by the in-service programs they were viewing, asked for special attention to a neglected area, science education. Annually, a city-wide Science Fair attracts entries from many elementary buildings. Individual building fairs are used to screen participants, and these projects are thought to be unusually potent opportunities to excite youngsters about nature and the rudiments of chemistry and physics.

The topic seemed a good way to involve staff from the Rockford Schools audio-visual department. The Michigan team hastily identified science program participants and designed a rough shooting script that did not call for any classroom scenes. Audio-visual staff handled camera and lighting (their own equipment) and oversaw editing. Interactive and one-way versions were produced in which a science teacher was interviewed about how teachers without his background could get fair projects started in their classes. Another teacher related her experiences encouraging others to stimulate students' interests in science. An offer of free materials that could be used to motivate students concluded the show.

This program was planned and produced in less than four weeks, including inevitable gaps between visits by Michigan staff to Rockford.

Expenses for program production are presented in Table 2-3.

TABLE 2-3

COSTS FOR TELEVISION PROGRAM PRODUCTION

Task	Staff level and hours	Direct costs
Participation in location shooting for seven primary in-service programs	Senior project director: 49 hours Project aides: 80 hours	
Crew costs, including equipment, for seven primary programs (director, cameraman, engineers and grip)		Contracted at $107 per hour: $4,922*
Videotape and other telecommunication materials for seven primary programs		$1,079
Crew meals during production of primary programs		$331
Graphics for primary programs		$482
Local transportation for primary programs		$217
Audio for primary programs		$162

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*This does not include travel time for crew or equipment.

TABLE 2-3 (Continued)

Task	Staff level and hours	Direct costs
Videotape editing and assembly for primary programs, including interactive segments	Senior project director: 69 hours Television director: 51 hours Editor: 46 hours Project aides: 93 hours Secretarial support: 16 hours	Editing equipment charges at $15 per hour: $690. Other equipment access (control room, film chain, studio camera for titles, etc.): $414
Science Fair program production	Senior project director: 9 hours Television director: 3 hours Project aides: 7 hours Secretarial support: 2 hours	Materials, tape editing and assembly, audio and other costs listed separately for primary programs: $176

Promoting in-service on cable.

Potential users of a communication service must be prepared for its introduction. We selected promotion tactics that would pale in the world of commercial advertising but are realistic for use in the public schools.

The senior project director spoke at a district-wide principals' meeting to describe goals in using television for in-service training and to answer questions. He also visited individually with each of the 28 principals of experimental schools--in their offices--to discuss what the television programs would look like, the content they would carry, and--in interactive buildings--how the user's terminal worked. We asked principals to support televised in-service and encouraged a sense of involvement and enthusiasm with the project. But we emphasized that viewing was voluntary. Additional visits by the project's co-director were used to locate viewing rooms and make technical arrangements for additional cable drops or television monitors if needed.

As the time for program delivery approached,attractively designed brochures were distributed to teachers in all experimental buildings. Different versions were written for one-way and interactive schools. In words, graphics and photographs,the mailing explained the use of cable for in-service and alerted staff how they could gain access to the programming.

We hired a retired and widely respected elementary teacher to serve as contact person. She visited interactive buildings and held staff meetings to demonstrate use of the terminal. She demonstrated log-on procedures and the potential rewards of interaction using a five-minute demonstration tape whose showings were coordinated with school visits. An illustrated sheet was left with each teacher and at each television set containing three simple steps viewers used for logging onto the system. Teachers were presented with individualized cards containing three letter codes for logging on.

Her visits to one-way buildings drew teachers' attention to the coming programming. In both sets of schools our staff member identified herself as the project's representative in responding to questions, equipment malfunction, complaints, or any other need to communicate, and she left a telephone number where she could be reached.

Our representative installed three-by-four foot posters in each experimental school's teachers' lounge advertising in-service on cable. These were prepared by professional graphic artists and featured color photographs of actual programs in production. The posters in interactive schools showed a teacher using the terminal while viewing a show.

Our representative also informed teachers about specific viewing times for programs by distributing schedules on a regular basis. Current schedules were kept posted at viewing locations.

The holiday break marked the end of our three programs about metrics and the start of four shows dealing with language arts. When teachers returned to school in January they found an attractive flyer in their mail boxes outlining topics in the language shows and announcing the teachers they would see demonstrating classroom ideas. The first show they were offered, however, was our recent addition about Science Fairs, which was separately promoted. Each of our programs was available for viewing across three to four weeks depending on holidays and other released time. As we neared the end of each program's run, an inexpensive offset newsletter was distributed advertising the next offering. Often these mailings featured a wry cartoon poking fun at the project for an equipment breakdown or exaggerating the enthusiasm teachers might show for the ideas we broadcast. We sought candor about our undertaking and a sense of humor about what we could expect to accomplish. Newsletters also drew attention to the schedule during which the subsequent show could be viewed. Periodically during the eight months of program delivery questions arose about system operation, our reasons behind scheduling or other topics. Responses to these were included in newsletters.

Our representative dropped by experimental schools on a regular, but unannounced schedule. Some of these visits were required to leave free teaching materials that had been requested (see Chapter 3). While in buildings she listened to comments about programming from teachers, principals and other staff and made certain that television monitors were conveniently located and reception quality was good, including color tuning.

Promotional efforts were balanced between one-way and interactive conditions to avoid favoring one delivery technology. We sought to equalize the number of visits by our representative to the two kinds of buildings for the same reason. But in the end interactive schools received more of these contacts, largely because we wanted to keep close tabs on the quality of signal delivery and the equipment's operating integrity.

We have evidence from post-experimental interviews that these extra contacts did not contaminate results showing superior benefits from interactive over conventional cable delivery. We will discuss contacts further in the section on findings.

TABLE 2-4

COSTS FOR SERVICE PROMOTION

Task	Staff level and hours	Direct costs
Contacts with building principals	Senior project director: 61 hours	Local travel: $110
Design and preparation of promotional materials--posters, leaflets, schedules and the like	Senior project director: 14 hours Project aide: 23 hours	Art, printing, etc.: $1,309
Training and coordination of contact person	Senior project director: 13 hours Project aide: 21 hours	
Contact person's functions: training teachers in terminal use, distributing materials, checking equipment, etc.		Contracted services: $3,274 local travel: $477
	Secretarial support: 19 hours	

Delivering in-service.

We drafted the experimental design with 14 one-way and 14 interactive schools participating. During the summer prior to service delivery Rockford administrators closed one of the interactive buildings due to declining enrollment; we converted a nearby one-way school to interactive in order to maintain 14 two-way sites. Most of the children and many teachers from the closed building were being relocated to the substitute.

During the summer it also became apparent that a cable drop could not be installed in another of the buildings designated for one-way service. We discovered an error in municipal maps that had mislocated the building within Rockford Cablevision's franchise area. This one-way school was reassigned to the control group--leaving us with 15 controls, 12 one-way schools and 14 interactives.

Effort was required at each of the 26 experimental sites to locate a convenient room for viewing and to install equipment. The project's co-director would visit a principal, tour the building and select the best situated room available. Ideally this was an unused conference room near the teachers' lounge, close to an existing cable drop or to a telephone pole from which one could be strung. In most buildings we found a comfortable room for viewing, partly because enrollment shrinkage had freed enough space so that work areas could be shifted at our convenience. In one-way buildings the school's television monitor was moved permanently to our room for the project's duration. Some sets were color, others were black and white. In interactive schools we supplied a color set so we could install a standard linkage with the user's terminal.*

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*These sets were purchased on a half-and-half shared basis with each school and remained the school's property when the project ended.

TABLE 2-5

SUMMARY OF COSTS

Task	Staff level and hours	Direct costs
Location of viewing rooms in experimental schools and supervision of equipment installation	Senior project director or co-director: 48 hours	Local travel: $148
Maintenance of interactive drops, amplifiers and terminals by Rockford Cablevision		$5,792
Television set maintenance by local vendor		$82
Playing interactive in-service tapes*		$4,000
Computer system maintenance		$3,940
	Secretarial support: 17 hours	

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*Amount reported here is for the share of the employee's time spent on this task.

Rockford Cablevision contracted to supply cable drops and to hook up terminals. Television sets were tuned and serviced by a local firm. To staff time used for installation, we should add 24 hours required by the Rockford Schools plant supervisor and 21 hours by the audio-visual services supervisor to oversee this work.

In-service tapes were "aired" on the interactive system as often as nine times daily, five days a week. An employee of Rockford Cablevision was assigned to play tapes as part of the project's contract with the firm, in whose quarters we located the interactive system's computer and other organizational equipment. One-way programs appeared on the school system's regular educational channel before and after school; tapes were run by audio-visual services staff normally responsible for delivery throughout the day of other programming intended for instructional use.

Timing of program delivery emerged unexpectedly as a significant issue. Busing schedules in the Rockford district required that elementary schools operate on four different time schedules. Additional complications resulted from varying lunch periods and slight, but important differences in clock settings at schools. Announced viewing times were convenient to some of the teachers some of the time, but never to all of them.

Program length varied from 24 to 43 minutes, a range that seemed acceptable when production started. But between production and the period of service delivery, failure of a school bond election cut valuable hours from the free time that had been budgeted each week for teachers to prepare class work. We had counted on these hours for program viewing. Teachers were left with three 30-minute periods a week.

Consequently, most viewing took place during a fraction of the presentation schedule--before and after formal school hours each day.

Cost analysis for producing and delivering programs.

The allocation of hours and dollars to several project functions has been calculated to inform others who might wish to apply a Client-Centered Production System to the development of in-service training. Several expenditures necessary for project completion have been eliminated and other simplifying assumptions made so that the reader can more accurately extend cost figures to different institutional settings. These omissions and simplifications mean that the Rockford field experiment cost many thousands more than its replication would entail, but replication would require investment in overhead and start-up that cannot be estimated here.

The most obvious differences between our costs and any future adaptation of interactive cable include funds we invested in equipment and research. Telecommunication technology is changing rapidly; sums we spent on the computer, terminals, amplifiers and other facilities will not be instructive. Criteria for amortizing this investment over hours of use are obscure under the best of circumstances. Research costs are clearly specific to this project, although any well-managed organization wishing to adapt interactive communication to its purposes will need to plan some monitoring of use and effectiveness.

More subtle factors shaping cost figures about to be summarized include the following:

1) Our MSU collaborators and we were pioneers at the time projects began in 1975. The technology of interactive cable was undeveloped,

few had experienced the burdens of implementing computer software to manage a system with many remote digital inputs needing coordination with broadband outputs. While much of this learning fell heaviest on colleagues at Michigan State and Rockford Cablevision, our school project was sufficiently novel to preclude a one-to-one imitation of the firefighter experiences.

The technology of small-format videotape production evolved while our experiment was getting underway. MSU's firefighter programming, begun a year earlier, chose studio production combined with graphics and a limited number of location stills. We elected to capitalize on the economics and flexibility afforded by the mini-camera and associated equipment. These permitted location shooting under naturalistic conditions at an attractive price. But the Michigan staff had to adapt their production habits, formed in the days of film and studio work, to the new possibilities.

The development of Michigan capabilities in interactive cable technology and small-format video production have not been included in cost figures summarized here.

2) To this technical learning we must add a second variety, the invention of CCPS. This innovation is one of human organization and processes of interaction and decision making--not wires, punch cards and videotape. Time devising ingredients of CCPS is not included.

   In our accounting of program production we have sought to find boundaries between developing procedures and implementing them at the project's site. Costs of implementation are included here, but the reader must appreciate that margins between tasks are often hazy and difficult to pinpoint with even the most detailed notes.

3) Project hours reported here include a block of time invested because we were strangers to our clients and not coworkers. The iterative process by which we identified program participants and the extra effort required to sustain working relations with school personnel (after project approval had been granted) cannot be isolated. Those who might adapt CCPS within their own work setting would not face the same needs we experienced as academics from a distant University.

   While our partners in the Rockford Schools remained enthusiastic and supportive throughout the project, getting to know one another took time.

4) Hours of personnel time do not include the enormous absorption by travel between Ann Arbor and Rockford. Nor have we shown direct expenditures for travel.

5) Hours for personnel include only time spent directly on project tasks, and use of these figures as guide would need to assume requisite skills are already present institutionally and need only be diverted from other tasks to the production and delivery of in-service. Start-up costs for hiring persons to fill roles and the inevitable overburden of "wasted" time associated with any job have not been calculated.

Table 2-6 lists personnel and direct costs associated with various phases of production and distribution. Hourly rates applied are: $17 for senior project director; $15 for television director; $12 for videotape editor; $8 for project aide; and $5 for secretarial support. The field crew's hourly figures are folded into standard billing rate (shown earlier) used by Michigan's Television Center.

Production costs.

Some $20,379 was invested directly in producing almost 220 minutes of edited programming delivered in both standard and interactive forms. For the seven primary shows this means an average of almost $92 per minute, an extraordinarily economical rate.

One should recall, however, the criteria for cost estimates detailed above. Production of the Rockford programs within an experimental context made use of existing television resources, under contract, and planning and scripting skills that were diverted on short notice to project demands.

Added cost of interactive service.

Of total expenses for program design and production, we estimate that slightly more than $1,000--or six per cent--resulted directly from preparation of interactive components. This is composed of 24 hours by the senior project director, 31 hours by project aides, audio recording and equipment use. Videotape editing and program assembly were complicated

TABLE 2-6

	Needs Assessment	Program Design and Scripting	Program Production (Seven Primary Shows)	Promotion In-Service	Delivery
Personnel	$1,691	$3,488	$4,787	$1,943	$901
Direct Costs	$1,576	$313	$8,524	$5,170	$13,962
Subtotals	$3,267	$3,801	$13,311	$7,113	$14,863
Total Expenses	$42,355				

somewhat by the need to incorporate interactive segments; laying time codes on one of the audio tracks, and "tuning" computer controls of interactive displays to these codes absorbed additional staff time.

We have no records separating these assembly functions from other production activities, but they would not come close to increasing the hours just reported by one half. It is fair to conclude that interactive videotape production is hardly more costly than preparation of regular programs. But interactive delivery is distinctly more expensive, as one would expect. Of the almost $15,000 invested in this function, $10,475 can be traced to establishing and maintaining the computer-interactive system.* Thus, about 27 per cent of our total cost for delivered and promoted "product" would seem to have been incurred from use of an advanced technology.

In several respects this is an inflated bill that appears to have been rendered by two-way cable. A review of the figures at the end of the section describing delivery shows why. We find the principal items due to maintenance. During the risky period of introducing telecommunication in an experimental environment, both universities felt it prudent to over-invest in maintenance, signing contracts for monthly payments that would assure quick response to service calls.

Our maintenance needs from Rockford Cablevision turned out to be astonishingly small, and most were linked to a product design flaw described earlier. Service calls actually required engineering and repair that Cablevision would have billed at under $500. Based on operating experience, we judge that $100 per site, or

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*This figure omits a portion of the costs for locating viewing rooms and monies spent to play interactive tapes. A staff person to drop videocassettes into a tape deck is required for one-way service just as surely as for interactive. Our project labored under a separation of sites from which one-way and interactive tapes originated, but this was an accident of short-term organizational factors. There is no reason to assume repetition of such an awkward arrangement.

$1,400 for the length of our delivery period, would be an ample sum to budget for keeping amplifiers, drops and terminals in good order.

Requirements for computer maintenance turn into another technical wraith--if one is willing to endure some delay in service response. Costs will vary, of course, depending on physical proximity of a qualified service representative; we could have set aside $150 per month of service delivery, or $1,200, and had money to spare.*

Under these operating assumptions, the total cost of supplying our seven-program service interactively and in one-way mode comes to $34,996. Approximately 21 per cent of this figure results from added costs of interactive production and delivery. Speculation over whether added cost is justified by a margin of benefits, comparing conventional with interactive cable, awaits discussion of project results.

One doubt concerning use of cable for in-service can be laid to rest, though. Its cost earns serious consideration of the medium, even if effects are no greater than familiar forms of staff training.

Consider raw quantities--not the most refined evidence, but illustrative. We produced almost 220 minutes of television in the primary shows, or 3.7 hours. The direct outlay for production and delivery in interactive mode was nearly $28,000, subtracting promotion costs. If all elementary teachers were required to view our shows, as they are compelled to attend institute days, our budgetary investment equals about 60 per cent of the cost in teachers' salaries consumed by an institute day. The programming hours we produced equal about 50 per cent of a work day.

We would argue that the seven shows more effectively delivered a greater variety of teaching innovations than could conceivably be presented in an equivalent amount of massed, teacher time. But even if immodesty about the shows deceives us, and they are only as good as lectures before a crowd of 700, programs cost about the same as institutes.

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*We cannot say how maintenance charges would change as facilities age.

Chapter 3

MEASURING EFFECTS:
EXPERIMENTAL DESIGN AND FINDINGS

Most field experiments yield equivocal results, and this one is no exception. Difficulties of interpretation result mainly from problems in identifying the independent variable. Policy interests that channeled federal support to our research centered on the added value of interactive, compared to conventional cable television. Increased costs of capitalization and program delivery spark an interest in whether the margin of benefits, if any, might reasonably match the margin of additional investment.

To the best of our ability interactive and one-way videotapes were alike, with the exception of terminal response and feedback. But necessities of delivering social services in a real environment introduced contaminations that inevitably cloud results.

Most important, of course, is the programming itself. The particular content we included may have been catalyzed uniquely by our interactive probes and have stimulated audiences in ways not easily matched by future programming choices. The science of analyzing learning processes associated with television is too primitive to permit specifying this possibility beforehand or controlling for it analytically afterward.

Enough has been related about our efforts at promoting programs to indicate that experimental buildings were exposed to televised in-service enveloped in a swirl of attention to teachers' opinions and felt needs. Did the programs or the attention produce results we are about to report?

It was not possible to establish an airtight control group of schools where parallel in-service would proceed using conventional media. A host of equally plausible attacks on this project's design weakens confidence that results can be attributed to a single technology, or that differences about to be described would emerge in replication. But we were able to exercise care in research procedures and measure a few contingent conditions enabling one to dispose, at least tentatively, of some of the more devastating alternative explanations.

Experimental design.

Of the 54 elementary buildings in Rockford, a handful are located close enough to cable trunk lines to permit economical two-way delivery. We approached Rockford Cablevision with our total budget for installing amplifiers and other line equipment required for digital upstream signals and asked company engineers to identify the largest number of buildings they could serve. Their total came to 14.

All were located along an east-west corridor and a north-south axis that intersect in the middle of town; few outlying buildings were included. To recover, at least partly, from this purposive designation of one experimental group, each of the 14 buildings was matched with the closest pair of non-designated schools in terms of student racial composition and median years of adult education in the residential areas served. One of the matched pairs was randomly assigned to the one-way cable condition and the other to control. In all, 42 buildings took part in the experiment, though as we have seen this number was reduced by one.

Data were gathered before and after the period of experimental program delivery, which extended across an entire school year. A delayed-after interview was scheduled for the following autumn to detect the endurance of project effects, if any. Teachers in grades one through six and their principals were contacted, excluding special education and kindergarten teachers.

We worried that the interviews (all conducted personally by trained staff of a market research firm with which we contracted) would constitute a potent stimulus in themselves. Hence a Solomon Design was arranged in which a random two-thirds of staffs in each building were contacted the spring before programming started; all teachers and principals were interviewed the following spring after delivery of our final show had ended, and all were interviewed the next fall for delayed measures. Completion rates for designated sample and populations were 93 per cent, 91 per cent and 90 per cent in the three waves. The remainder refused or were absent from school too often for us to reach during data collection periods, which usually lasted three weeks.

Although the Solomon Design would not control for "pass-along" interview effects--in which uninterviewed teachers in a building might be influenced from knowing about our contacts with co-workers--it would assess any direct effects. Unlike a design in which the entire school staff might be interviewed or not, our Solomon layout did not incur a clustering effect with its damage to degrees of freedom in analyses of variance.

Inspection of building and treatment means for number of teaching ideas at Wave 2 reassures us that interview effects were negligible. Number of times a person was interviewed explains only one per cent of variance in ideas. Equally important, there is no interview-by-treatment condition interaction. This can be visualized by comparing the amount of variance explained by the sum of interview and treatment with amount explained by this sum added to an interaction term between the two variables; this difference equals a .1 per cent (one tenth of one per cent increment.)

The Solomon Design was not needed to insulate experimental outcomes from effects of repeated measures. Regardless, we will rely most heavily on Wave 2 data for reasons that will be spelled out later.

The interview.

Our interests in professional work ranged widely. We inquired about the availability of recognition from others in the workplace, the values teachers and principals sought from their careers, experiences with conventional forms of in-service training, social structure in buildings, and--as one would expect--experience with and evaluations of our cable programming. Information about teaching experience, years of schooling and other formal characteristics completed our questioning.

Detailed interview records were compiled during all waves of data collection, and contacts in a random ten per cent of cases were confirmed independently. Measures for specific variables will be described as findings are presented. But the criterion measure of experimental effects merits special scrutiny.

Major experimental outcome.

A Client-Centered Production System appreciates variability in the processing of work information and application of ideas to job demands. We recognized that programming could be interpreted and used in many different and unpredictable ways. Standardized tests for telecommunication effects would unearth only a distorted fraction of the outcomes we might expect from in-service.

Our sponsors, the National Science Foundation and National Institute of Education, asserted their own priorities, only part of which could be realized in the application of cable we tested. They sought assessment of the value of interactive service for work "productivity," a concept frozen with expectations about the end product of professional service. The productive teacher might be one whose students attained the greatest improvement in verbal or mathematical skills after a year's guidance. Or, productivity might be interpreted as fraction of college admissions six to 11 years later. Or, vocational success. Or, range of cultural interests in midlife. The list of socially desirable rewards from education proliferates.

Some of these dimensions are clearly beyond reach of a two-year experiment; the value of others is arguable. Our quest for a dependent variable led to a more proximate effect, one that bears the imprint of social values just as surely as candidates we rejected.

Educators in the public schools are professionals, although in some ways they seem determined to relinquish this cloak of status. Teachers are licensed for competence through formal procedures sanctioned by political authority. Specified training through university work is mandated. This training asserts theories about proper ways to promote learning and social adjustment, even though the empirical base of these systematic understandings is open to quarrel and challenge from competing points of view. Teachers are expected to strive toward the betterment of society and take some joy in furthering community interests, sacrificing some of their more personal aspirations. Professional associations of educators act as forums for exchanging information about the practice of teaching and about ethical work standards.

Unionization and the celebration of seniority, contracts that dwell on salary and fringe benefits, and the bureaucratization of job requirements may weaken professionalism. But in the face of these trends school teaching persists as an arena of individualized performance--remote from clients' judgment about worth and exposed to colleagues' opinions of success. Teachers work alone with their charges; authoritative monitors enter classrooms with difficulty.

In the face of these circumstances, how can one judge improvement in job performance? Only in a limited way, we concluded. We reasoned that teaching quality rests on openness to new ways of getting the job done, however that job might be defined. New ways are innovations, not only in what is taught but how it is conveyed; assessing correctness of these ways demands longitudinal study of great complexity and sophistication unattainable in a project of our scope. We would be content to note whether teachers were alerted to ideas or methods about their work and evidence that this alertness could be traced to in-service experience, some of which our project was responsible for crafting.

Furthermore, discovery of new teaching ideas would have to result from voluntary response to our experimental stimuli. In a professional atmosphere usable techniques are discovered, not compelled. Teachers should be free to view or avoid programs; individuals should be free to interpret their contacts with innovations in varied and creative ways; measurement of these contacts should preserve this freedom and variability.

Accordingly, the three waves of interviews asked:

> Are there any ideas or methods you've seen or heard about during this semester (or during the past year in Wave 2) for different ways elementary teachers might do their work?

Once we secured descriptions of ideas and methods we pursued teachers with more questions. The resulting details suggest that the ideas we uncovered are meaningful and applied ingredients of our respondents' professional work. Appendix B compiles all questionnaire content across the three waves of interviewing. We summarize findings about teachers' new ideas to affirm confidence that this measure represents a reliable guide to their potential for classroom innovation, even though we were unable to observe contacts with students or learning effects directly.

The most fruitful look at ideas teachers had encountered recently draws on the immediate post-experimental interview and examines detail we sought about teachers' first mention.* Those who reported new ideas got them from a variety of media and interpersonal sources. In experimental schools television figured prominently, as one would expect. But other sources contributed too, in both control and experimental buildings. Magazines, especially educational journals that are found in most teachers' lounges, were cited most often--in connection with almost six out of ten ideas. Other teachers as sources, formal meetings (such as conventional in-service) and books were frequently mentioned. Few teachers attributed innovations to their principals. The average teacher with an idea mentioned almost two sources contributing to it; multiple source use is the rule, not the exception.

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*It will shortly be clear that few teachers claimed more than one idea encountered recently.

Once teachers have encountered a new idea they might use, they discuss it with others--almost always other teachers. Only about one-third of new ideas are talked over with principals, the same frequency of contact enjoyed by teachers' family and friends outside of work. (Almost a third of the discussions with principals were accounted for by teachers in just four of the 41 buildings. Apparently there are a few exceptional principals consulted by their staffs about innovations, but not many.) As with idea sources, discussions usually involve multiple partners, not just one person.

Teachers had a great deal to say about advantages and disadvantages of ideas for doing their work differently, and our interviewers recorded as much detail as questions would elicit. When teachers were pressed to describe advantages, 60 per cent named two or more (almost a third described three or more).

Teachers were not blind to the liabilities of new methods either. Well over half described at least one disadvantage. Moreover, the tendency to describe attractiveness of innovations correlates positively with knowing the unfavorable side, too. The coefficient between number of advantages and disadvantages is .23 (product-moment; $p < .001$, two-tailed). In fact, nearly four out of ten teachers described two or more good points and at least one flaw relating to their idea.

The preponderance of good points over bad is not surprising. Eighty per cent had already tried the idea, and most reported it had worked successfully. About seven out of ten also said other teachers were using the same idea.

The findings just reviewed lead to three observations about innovative ideas teachers encountered and were able to describe. First, ideas that emerged in the give-and-take of questioning appear to be serious and significant parts of teachers' orientation toward their work; they are not interview responses offered out of diffidence or boredom. Respondents possessed a great deal of information about what they had seen in media or heard from others. They shared this information with interviewers. As will be seen below, we were able to code the content of this information in highly reliable ways, using a 51 category system that noted fine differences among ideas.

Second, our questions snared ideas teachers had started trying during the year, innovations they had observed others using. Apparently we tapped real, not hypothetical behavior in the classroom. Perhaps we would be more impressed with the potential for innovation by teachers if our measures had collected greater numbers of ideas, many in the thinking rather than acting stage of classroom use. But as compensation, there is a strong whiff of reality to responses that were gathered.

Third, building principals, the dominant authority figures in teachers' lives, play a weak role in stimulating innovation or sustaining it directly through social interaction. This means that whatever grouping of innovation occurs within a school owes much of its vitality to collegial relations among teachers. It would seem that innovation seldom involves administrators. We will return to this issue shortly.

Units of observation.

Schools, not teachers, were assigned by probability methods to experimental conditions. Buildings, therefore, serve as the appropriate unit of analysis, but more than attentiveness to statistical models explains our adherence to this procedure throughout most of this report. To explain we must jump ahead to pertinent findings.

For the moment we shall examine our programs' popularity from the standpoint of individuals; they are so logically the "units" that decide whether or not to view. In fact, unlike commercial television watched most often in family groups, experience with cable in-service was established to encourage solo viewing. In any single building teachers' available time for using telecommunication media is scattered across the work day due to conflicting classroom obligations. Even before and after each school day teachers within a building differ by important minutes in the most convenient times to start and terminate viewing. We located television sets in special rooms to enable private use of our service.

In another way, however, we permitted exposure to in-service to become a shared experience. To aggregate an audience across time, programs ran repeatedly. Solo-viewing by a teacher at one occasion could easily turn into shared use of the system later as more and more of a building's staff tuned in at times dictated by their individual schedules.

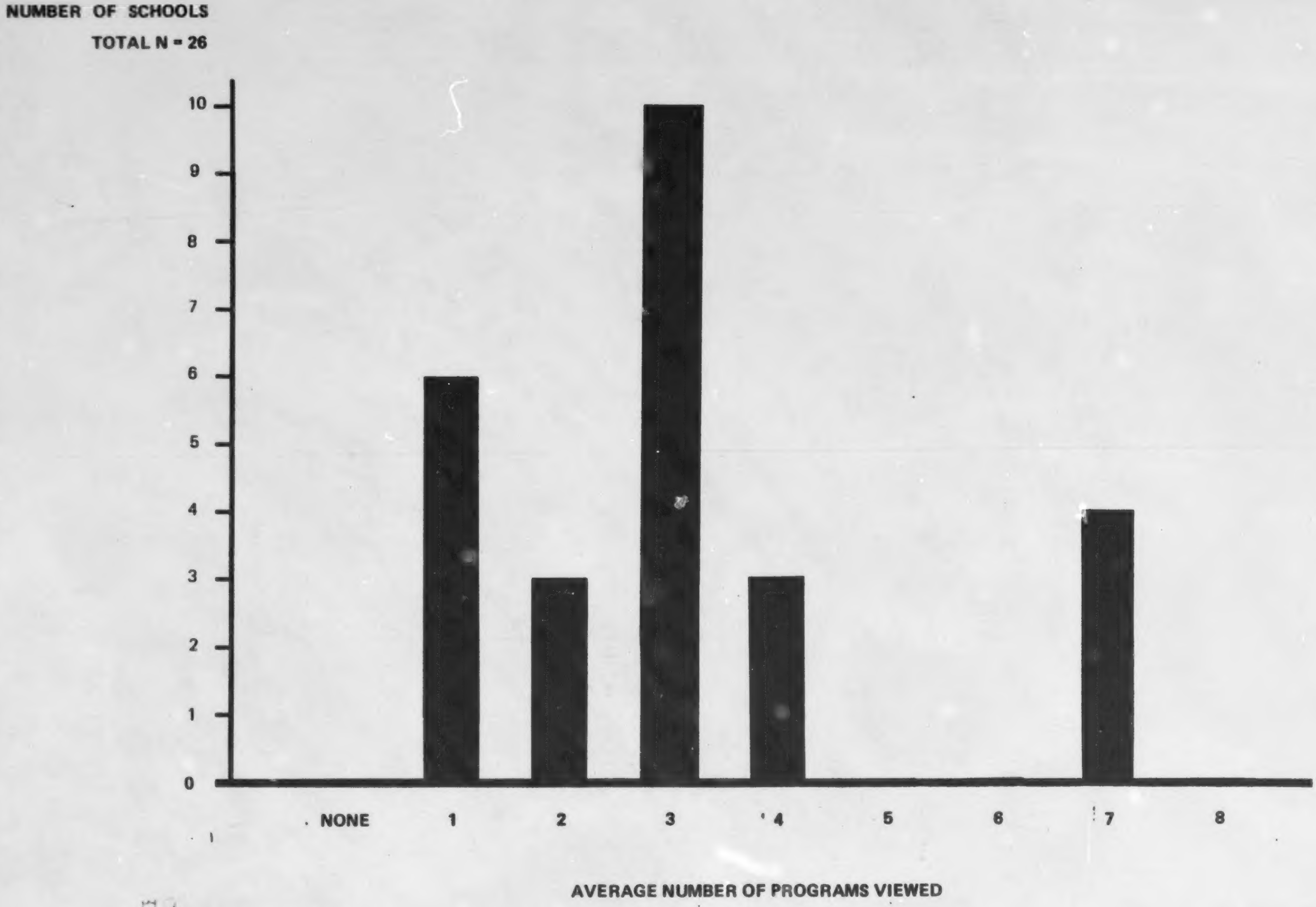
That shared viewing was the norm and not the exception becomes clear by examining teachers' average program exposure, building by building, separately for the two experimental conditions. In each group of schools the intra-class correlation shows precisely 46 per cent of variance in number of shows watched accounted for by building.

This offers evidence for a considerable "starling effect," where one teacher's decision to view or not view spreads by contagion to others, resulting in a lump of individuals using in-service on cable to a similar extent. Thus viewing and non-viewing, and popularity or unpopularity of individual shows, reflect the judgments of groups of teachers rendering their decisions through social processes. The nature of these processes will be dissected later in this report. For the moment it is sufficient to emphasize the magnitude of clustering: All the social and physical constraints (and incentives) common to teachers whose professional work takes place within the same buildings explain half the variability in using our telecommunication service. By subtraction this leaves half the variance in viewing to be apportioned between teachers' idiosyncratic decision processes and the error that inevitably accompanies measurement of viewing by a combination of aided and unaided recall methods, weeks or months after the behavior has occurred.

Clustering in viewing (and in telecommunication effects) is so important to our subsequent analysis that it deserves graphic display. Interactive and one-way buildings form distinct modes of program viewing, as Figure 3-1 shows. Among the 26 schools scattered across Rockford, staffs in six buildings viewed only one in-service program on average. Faculties of three schools viewed two programs, on average, while teachers in 10 schools watched about three. A handful of staffs viewed approximately four shows; none watched five or six programs. A cluster of four faculties viewed around seven (actually between 6.50 and 7.49) programs, and no group of teachers watched an average of all eight productions.

The unevenness of this distribution attests in a different way to clustering and documents the significance of buildings as units for studying telecommunication effects. These findings, plus the fact that our experiment assigned schools and not teachers to different treatment conditions, explain why most subsequent analyses in this report use building averages for variables or pry apart social and authority structures within buildings influencing the adoption of telecommunication services and the impact of cable television on work behavior.

AVERAGE NUMBER OF PROGRAMS VIEWED IN EXPERIMENTAL SCHOOLS



Basic experimental effects.

We first test the principal effects of in-service on cable by comparing experimental conditions on number of teaching ideas. After seven months of almost continuous programming, presenting eight shows covering six distinct teaching areas, did schools differ in the number of ideas or methods their staffs had recently encountered for use in daily classroom work?

Table 3-1 shows building means drawn from immediate-post interviews with virtually all teachers in the 41 participating schools (N = 506).* The overall F-value is 1.85 (p = .17, one-tailed), and means are in the predicted direction. We can conclude on grounds of statistical significance that in-service on interactive cable produced a detectable difference from the no-treatment condition--in light of the amount of within-treatment variance among schools of each type.

Statistical significance offers only one criterion for assessing results, however. Due to the modest number of schools in the experiment, limited degrees of freedom in analysis place a heavy burden on the data; we should examine distributions more closely in order to gain an adequate picture of telecommunication effects.

It is convenient to start with the control group of schools, where fewer than half the teachers could describe a single new teaching idea they had encountered during the past school year. This is a depressing discovery given the permissive scope of our interview questions. Many buildings had continued

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*The same questions about teaching ideas were asked in interviews with a random two-thirds (N = 329) of teachers during the spring before the experimental program year. We expected these data gathered before the introduction of television service would enable more sensitive tests comparing experimental conditions. However, we found buildings in the three conditions remarkably equal in average number of teaching ideas; use of the pre-experimental data sacrifices more analytic power in lost degrees of freedom than is gained through reduction in error variance. Consequently, we have not used pre-experimental data in the present analysis.

TABLE 3-1

MEAN NUMBER OF TEACHING IDEAS PER SCHOOL IMMEDIATELY FOLLOWING EXPERIMENTAL PERIOD

	Control	One-way	Interactive
	.81	1.04	1.20
N=	15	12	14

Control vs. Interactive	p=.032 (one-tailed)
Control vs. One-way	p=.149 (one-tailed)
One-way vs. Interactive	p=.235 (one-tailed)

their conventional in-service activities with monthly staff meetings, occasional institutes and the like. But the impact of these efforts appears negligible.

The incidence of new ideas in one-way buildings is greater on average, but still the mean indicates approximately one idea per teacher only. Interactive buildings are above one-way schools and much higher than controls. For the first time we see evidence that over half of teachers have encountered some new ideas or methods during the year for different ways they might go about their jobs.

Differences between experimental groups can be visualized in even clearer light using the rough categorization in Table 3-2. It distinguishes among buildings with fewer than one idea per teacher, on average, those with one to two ideas and those with more than two ideas per teacher. The number of buildings with markedly few ideas drops dramatically when one moves from control to one-way to interactive conditions. The proportion of schools where teachers describe one to two ideas on average jumps from around a quarter to almost six out of 10. The only schools where the average teacher has encountered more than two new ideas in the past year are found in the two experimental conditions exposed to in-service on cable.*

We would argue that the array of buildings in Table 3-2 shows sufficient differences produced by cable television to imply policy choices, even though the more technical and statistical test presented in Table 1 demonstrates

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*Analysis tracing whether innovativeness can be attributed to different telecommunication services offers a stronger test of cable effects than questioning teachers about perceived effects. Post-delivery interviews gathered some attitudinal data, however, including open-ended responses explaining why people viewed or avoided televised in-service. These results are reported in Appendix C.

TABLE 3-2

BUILDINGS GROUPED ACCORDING TO MEAN NUMBER OF NEW TEACHING IDEAS, IMMEDIATELY FOLLOWING EXPERIMENTAL PERIOD

	Control	One-way	Interactive
Fewer than one idea	11	6	4
One to two ideas	4	5	8
More than two ideas	0	1	2
N=	15	12	14

borderline results. The quantitative edge in ideas enjoyed by interactive over one-way schools is more than a just-noticeable difference. But the reader should apply his or her standard of benefit value in judging whether increased potential for innovation shown by teachers exposed to telecommunication warrants the effort to produce in-service for cable delivery. We will have more to say about comparative costs of conventional in-service and in-service on cable later in this report.

A check for contamination from conventional in-service.

The discussion of experimental design lamented the lack of a true control group. There are other ways that results we hope to attribute to telecommunication can be muddied by teachers' exposure to conventional, face-to-face training activities.

We begin with a backward glance at schools as they were before the cable project was launched. Conventional training was a part of regular staff meetings in many, though not all schools. About six out of ten teachers reported sessions took place in their building, usually as a part of regular staff meetings. But these gatherings were infrequent; more than a month passed between sessions in most places.

Perhaps as a result, we found no relationship between in-service activity and how many teachers possessed ideas about innovations in the classroom--before the experiment took place. Schools that held training sessions were no different from buildings where they didn't take place in mean number of new ideas among their staff. And--of great importance to the integrity of our experiment that was about to begin--no differences were apparent between schools that were to become interactive, those assigned to the one-way condition and control buildings. They participated in training sessions about equally and were alike in potential for innovative behavior (i.e., number of ideas).

These findings unveil the outlines of "business as usual." Efforts to improve productivity in a professional workplace were haphazard and ineffectual. Although institute days were scheduled and time was occasionally devoted to discussing teaching improvements, our interviews were unable to uncover encouraging evidence about outcomes. It is against this gray backdrop that we tested the effects of telecommunication services.

As we launched our experiment, conditions began to change, however. Earlier, failed bond issues were replaced by a successful election. Special education teachers were rehired. Funds were released for institute days and for training to prepare teachers to use new reading texts and other materials. Instead of 60 per cent of teachers experiencing some in-service in their buildings, 75 per cent described these experiences at the time of post experimental interviews in April, 1978. And half said in-service sessions took place every month.

Improved conditions benefitted all three groups of buildings--control, one-way and interactive. But without premeditation or intention, frequency of conventional building in-service increased the most in one-way schools. To the extent that accelerated training by familiar means might benefit teachers' capacity for innovation, conditions during the year we presented cable programs worsened for detecting advantages of interactive technology. Of course, the findings distilled from pre-experimental interviews cast doubt on the potency of staff meetings. But the increased frequency of these sessions might have yielded benefits we had failed to detect earlier.

And so, we should look anxiously at post-experiment data for signs that building in-service complicated our test of telecommunication services. Instead, we find evidence that effects observed for cable would have been even greater if conventional activities had remained constant. The renewed frequency of familiar in-service in control buildings correlated strongly (r = .64; p = .005, one-tailed) with number of teachers' ideas there. But the correlation was near zero in both experimental treatments.

The effect of a more vigorous program of building in-service during the 1977-78 school year was to accelerate the possibilities for innovation in control schools. Teachers' awareness of new ideas and application to their own teaching shot upward. But innovative behavior increased even more in the two experimental groups--especially among interactive buildings.

This lends an unexpected measure of confidence to our main results. Interactive program delivery does not look attractive merely when compared against the stagnation in training caused by financial woes in Rockford Schools. The new technology produced a significant margin of benefits when compared against the renewed and more effective offering of conventional in-service that took place in control schools after passage of a bond election.*

Persistence of effects.

In-service on cable ended with the school year. The following autumn schools and teachers were uncertain about possibilities for continuation of this training. Three additional programs about spelling had been produced by a teachers' television workshop we sponsored (see Chapter 4). But airing of these and continued use of the television system rested on negotiations with Rockford Cablevision to keep the interactive plant intact beyond termination of both Michigan State and University of Michigan projects.

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*Small number of schools (units of analysis) in the experiment forecloses entering conventional in-service into an analysis of covariance design. We must be content with more elementary forms of statistical inference.

It was not possible to make cabled in-service available during the fall. But we returned to teachers in November to personally interview those who remained in buildings where they had taught the previous year. Retirements and shifts in assignments reduced the scope of interviewing from 506 to 429 teachers. The bulk of our questions dealt with their most recent contact with new classroom ideas, since they had started the school year. Table 3-3 shows building means based on this delayed, post-experimental measure.

Each of the control and experimental conditions shows greater receptivity to innovations than found immediately after delivery of in-service on cable. The overall F-value is not significant, nor is any of the comparisons between treatments.

Improved prospects for innovation in control schools are probably results of the unexpected surge and effectiveness in conventional training just observed. The most important finding in Table 3-3 is that awareness of classroom ideas in one-way and interactive buildings remained steady after the television series was terminated. Means in November were slightly greater than the previous spring, encouraging confidence that the impact of cabled in-service persists, even across the inactive summer months.

Content analysis of ideas teachers reported to us during second and third waves of interviews is not finely enough drawn to determine whether the same or different classroom methods were being cited.

Range of experimental effects.

Our earlier discussion of experimental methods included details about the classroom ideas teachers reported to us. Teachers found it easy to describe both advantages and disadvantages of ideas they had recently encountered. Most were innovations they decided to try in their own work and had talked about extensively with others.

TABLE 3-3

MEAN NUMBER OF TEACHING IDEAS PER SCHOOL DURING AUTUMN FOLLOWING EXPERIMENTAL PERIOD

	Control	One-way	Interactive
	1.13	1.11	1.31
N=	15	12	14

The experimental tests above have embraced all the ideas respondents gave us.* Closer analysis distinguishes the content of innovativeness, or substantive range of experimental effects. A methodological digression into coding reliability is required to understand these results.

Recall that our primary question read:

> Are there any ideas or methods you've seen or heard about during the past school year (or appropriate time interval) for different ways elementary teachers might do their work?

Teachers claiming contact with new ideas were asked a battery of additional questions, starting with the fullest descriptions we could obtain:

> What are some of these ideas and methods? I'd like to write down each one. Any others?

As many as six were recorded with interviewers often asking teachers to distinguish between ideas where boundaries seemed unclear by asking, "Is that a different idea you're telling me about now, or part of the one we were talking about?"

The two most interesting ideas to teachers (possessing as many) became topics of more detailed questioning that has already been reviewed. But all ideas mentioned were subjected to a rigorous content analysis applying 51 categories. We sought to capture as much detail as possible about teachers' information processing.

We noted two facets of ideas. Some expressed the products of teaching--subject matter such as language arts, mathematics, sex education, science and the like. Other facets contained processes that might be generalized to almost any subject area--like use of motivational techniques, ways to maintain discipline, classroom management schemes, etc.

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*The inter-coder reliability for number of ideas, using Scotts' formula (1955), is .89.

Coders were trained to distinguish as many facets of ideas as seemed to appear. For the first two ideas a teacher might describe, up to three facets were coded from our list of 51 possibilities. For remaining ideas a maximum of two facets were noted, experience confirming that these limits were sufficient to include all the detail that could be gleaned from even the most garrulous teacher.

The extensive category system is collapsed for analysis below. But it was used to measure intercoder reliability using a probability sample of interviews. At this unaggregated level of data, Scott's coefficient (1955) is a reassuring .83--and certainly greater if responses are considered in merged form.

One reason for going to this trouble is to enable sharpened tests for experimental manipulations. In particular we sought to distinguish between idea content that found direct expression in our cable programs and other classroom methods. We expected this objective assessment to yield a less ambiguous reflection of telecommunication outcomes than could be attained by trusting teachers' recollections about where they had obtained each idea they told us about.

Among the one-half of teachers in the experimental design who described any ideas, five categories of responses stand out. Table 3-4 shows percentages of idea-possessing respondents who mentioned each kind. A sixth, residual category combines many products and processes that appeared too seldom to warrant special attention.

References to the two dominant products, verbal skills and mathematics, are self-evident. Responses commonly included new ways to tackle reading, writing, measurement, mastery of basic arithmetic functions and other staples. The most popular process mention, "classroom activities and motivational techniques,"

TABLE 3-4

MENTIONS OF DIFFERENT TEACHING IDEAS, AMONG TEACHERS WITH AT LEAST ONE RESPONSE

	% mentioning
Products:	
*Verbal skills	44%
*Mathematics	21
Processes:	
*Classroom activities and motivational techniques	32
Teaching approaches and philosophies	22
Classroom management and school policy	27
All other products and processes	24

(Mentions total more than 100% because of multiple responses)

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*Indicates topics prominent in cable programs.

TABLE 3-5

TESTS FOR TELECOMMUNICATION EFFECTS, SEPARATELY BY CATEGORIES OF NEW TEACHING IDEAS

Idea categories emphasized by in-service on cable	Mean percentage of teachers mentioning idea category, by school			One-tailed p-values	
	Cont.	One-way	Inter.	C-One.	C-Int.
Verbal skills	.16	.24	.29	.08	.01
Mathematics	.06	.10	.19	.17	.002
Classroom activities and motivational techniques	.12	.19	.21	.15	.07
Idea categories seldom mentioned by in-service on cable					
Teaching approaches and philosophies	.11	.09	.12	opp.*	.42
Classroom management and school policy	.11	.14	.18	.30	.09
All other products and processes	.27	.21	.23	opp.*	opp.*
N=	15	12	14		

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*"Opp." signifies percentage difference opposite from predicted direction.

included a wide variety of games and other techniques aimed at conveying classroom material in engaging and useful ways.

"Teaching approaches and philosophies" included such things as traditional compared to child-centered learning and a host of doctrines imparted by college courses in educational psychology. "Classroom management" spread across a range of disciplinary and bureaucratic issues. Three categories in Table 3-4 are starred to indicate their prominence as program ingredients on cable.

Average percentages for each category were calculated by school and entered into separate analyses of variance. Table 3-5 contains the means as well as probability values for the contrasts of greatest interest--control vs. experimental treatments.

These data support two conclusions. First, when attention focuses on areas of classroom innovations treated in television programs, one-way delivery exhibits less robust improvements over control schools than interactive programming. Second, among idea categories seldom mentioned on cable, only one comparison (between control and interactive for "classroom managment and school policy") shows even marginal significance; three of the six comparisons between means are actually in the opposite direction. Effects of interactive service are concentrated on issues of wide appeal.

An aggregate test combining the three programmed areas of ideas into a single index for each school produces a dramatic sharpening of the mean scores reported first in this chapter describing basic experimental effects. For the more focused dependent variable the F-ratio among experimental conditions equals 3.55 ($p = .02$; one-tailed)--which contrasts with a .17 probability earlier (see p. III-11). Average percentages of teachers with one or more of the three kinds of televised ideas are presented in Table 3-6.

TABLE 3-6

AVERAGE PERCENTAGES OF TEACHERS WITH AT LEAST ONE MENTION OF TELEVISED IDEAS

	Control	One-way	Interactive
	35%	53%	69%
N=	15	12	14

Control vs. one-way	p=.09 (one-tailed)
Control vs. interactive	p=.005 (one-tailed)
One-way vs. interactive	p=.13 (one-tailed)

Where only conventional in-service took place, about one-third of teachers volunteered learning about an innovation in the past year dealing with language skills, mathematics or classroom activities to increase students' motivation. The proportion of teachers was almost significantly greater in one-way schools and doubled in interactive buildings.

This represents a practical effect for new communication technology. We cannot estimate what the differences would have been were it possible to have scheduled institutes or other in-person training activities in control schools that matched the program content made available on cable. Such matching would have been difficult to achieve in any case. Television programs took viewers into classrooms to witness colleagues using their ideas, a communication experience difficult to simulate in a workshop before large audiences.

Importantly, we can see advantages to interactive viewing cast into sharp outline. Almost a third more teachers in interactive buildings describe programmed ideas than in one-way schools. The statistical probability of this difference fails to attain a conventional level of significance for avoiding the error of falsely concluding there were experimental effects. But given the absolute difference in mean values--and the analytic distinction drawn between innovative content appearing on cable and ideas not programmed--it is prudent to conclude that responsive television viewing with feedback promises benefits over conventional viewing. To infer otherwise flirts with an opposite error--unwarranted inference of no treatment differences.

A liability from telecommunication?

The net advantages from cabled in-service just observed--including interactive benefits--need to be viewed in an adequate light. Telecommunication services also increased cognitive homogeneity among school buildings, an outcome that might not disturb some, but others would find distressing. Buildings in both one-way and interactive conditions became stratified into idea-rich and idea-poor layers in what could be interpreted as another demonstration of the "knowledge gap" phenomenon.

The gap refers to a frequent outcome of increased communication intensity. As the volume of messages about a topic mounts, people who possess resources for interpreting and using those messages gain more knowledge than people lacking resources. People with partial knowledge gain a great deal more than people with no prior understanding. This describes a parallel in the world of information for the cruel maldistribution of other social resources, including wealth or food. As opportunities improve the rich often acquire more, and the poor become--relatively, at least--poorer.

What evidence have we of that consequence in Rockford? A quite simple test will demonstrate. Consider the six kinds of information about innovation listed in Table 3-5. A group of schools would appear unstratified if they ranked differently in number of teachers possessing each kind of information. That is, schools would be heterogeneous if the top-ranked building for information about new verbal skills ideas had few teachers with new thoughts about motivational techniques. Or if a building whose staff had encountered new ideas about classroom management had nothing to say about novel ways to teach mathematics.

This heterogeneity is precisely what we find among control schools. The average rank correlation (or concordance coefficient) among buildings, across the six idea clusters listed in Table 3-5, is .20. This falls far short of being significant. Schools are unique in which kinds of ideas have reached their staffs recently.

But the opposite, or homogeneity, prevails among both one-way and interactive schools. Here average rank correlations are .52 and .45 respectively (both highly significant; $p < .001$). Increased communication resources have stratified the buildings along all idea dimensions. To provide a particular case: Among experimental buildings, schools whose teachers have many new ideas about motivation techniques also have a great deal to say that ultimately gets coded "all other products and processes." Such is not the case among control buildings where new communication resources were absent. Frequency of the two idea categories is uncorrelated, the same pattern exhibited by all inter-relationships based on the six categories found in Table 3-5.

To this point lessons from our test of telecommunication are relatively uncomplicated. The first result may provoke a wide scholarly yawn, but perhaps an appreciative glance from practicing classroom teachers. Our telecommunication services functioned in a dispersed, localized, professional work milieu. Many teachers were isolated from stimulating ideas, some frustrated because college training left them with a shimmering vision of master theories for professional attainment. Into this dreary scene we injected televised programming about novel ways to teach, new conceptions of what is teachable.

Our clients responded by viewing (see section below) and incorporating ideas into their daily routines. A quick reading of findings suggests that in-service on cable is a success.

Control schools with their heavy menu of business as usual reported appalling levels of innovativeness. One-way buildings showed improvement. Interactive schools exhibited the greatest awareness of ideas painstakingly incorporated into videotape and sound. Computer aids to audience involvement may be worthwhile.

A penalty was paid in homogeneity of innovation. Schools that responded "best" to our experimental stimuli shot ahead on all types of ideas; laggards showed reluctance to adopt any novelty into their work.

New communication services stratify, not homogenize the educational world, but that is a price to be paid.

Interactive cable is superior to conventional. But some observers might judge the difference in delivery modes overshadowed by the contrast between lack of systematic and visualized training and availability of at least conventional televised service. A more searching look at our findings will assist practical application to problems of staff development and work productivity.

Added value of interactive experience.

Review of findings to this point has shed circumstantial light on benefits from terminal use. Major experimental results and subsidiary findings described below and in Appendix D show gains in potential for classroom innovations or suggest behavioral effects that may have been caused by interactive experience.

Analysis has not focused tightly enough yet on whether responding to questions enriched viewing; exposure to programs has been confounded in the data. More stringent standards must be imposed, confining analysis to teachers in both experimental groups who viewed one or more shows.

We start at the building-level of analysis. New aggregate scores were calculated for mean number of teaching ideas (based on overall totals) and mean number of programs viewed--using data for both variables from people who reported some watching only. Non-viewers with their paucity of innovations were eliminated from consideration.

We sought to learn whether amount of viewing--among those who did any--is associated with potential for improved work productivity. Viewers in the two experimental treatments watched the same events on screen; one group enjoyed additional opportunities to interact. If the exposure-by-benefit correlation were greater among interactive schools than found across one-way buildings, we would have evidence supporting value from the more costly technology.

This is exactly what we found, as the correlations in Table 3-7 confirm. Interactive buildings are innovative according to the amount of viewing that has taken place. Volume of viewing in one-way schools exerts no effects. Frequent opportunities for interactive experience yield valuable increments in teacher responsiveness.

The same result can be observed by analyzing data at the level of individual teachers, again excluding non-viewers. Those who watched few, some and many cable programs differed substantially in innovativeness if they were exposed to interactive experience, but not if viewing were confined to conventional, more passive television.

These findings remove at least some of the shadow on experimental results cast by memories of "Hawthorne effects". While it was not realistic to measure teachers' exposure to publicity that encouraged program use, it seems unlikely that heavy interactive viewers were more sensitive to this and other forms of attention than light viewers. Yet they certainly displayed a more impressive volume of experimental outcome, new ideas.

Such was not the case among one-way schools.

Social structure analysis.

Data in Table 3-7 disclose an immediate effect of televised in-service and suggest the superiority of interactive delivery. A study of telecommunication systems would be incomplete, however, without examination of social factors that shape their use and mediate effects. We present a number of comparisons between control and experimental conditions to shed light on how social structures accommodate cabled in-service.

Our expectations about the importance of social environment recognized unusual features of schools as workplaces. Schools signify the value of colleague relations in professional life by providing teachers' lounges where

TABLE 3-7

CORRELATIONS BETWEEN NUMBER OF PROGRAMS VIEWED AND NEW TEACHING IDEAS
(based on program viewers only)

	One-way	Interactive
	-.05 (NS)	.54 (p=.02)
N=	12	14

(One-tailed probability shown.)

staff can eat, visit or read during spare periods without classroom obligations. These social facilities, coupled with small faculty size in most buildings, result in teaching staffs who know a great deal more about one another than we would expect in larger, more bureaucratic settings.

Knowing about one another should not, of course, be equated with cohesion or with friendship. Social propinquity simply elevates the significance of social structure as an influential factor in work life.

We focus on two dimensions of structure. One is norm homogeneity, or the degree to which teachers agree on the definition of good professional performance. Teaching norms prescribe the range of acceptable, rewarded behavior in the workplace. Second is the degree of communication among the staff about work. Communication expresses the openness of teachers to sharing classroom experience with others.

In considering norms we recognize that elementary schools within the same district possess many common features. Curriculum guidelines are drawn district-wide. Books are standardized, usually within a choice of two to four approved texts. Common hiring standards, promotion criteria and compensation policies are mandated by union agreement.

But building differences emerge within these constraints. Individuals or groups of teachers fashion their own lesson materials. They experiment with novel team approaches, or solutions for remedial problems, or ways to pool materials. As years go by and building staffs remain relatively stable, buildings may become increasingly differentiated.

Our in-service programming represents a powerful attempt to navigate around this differentiation. By developing a Client-Centered Production System we enabled accomplished teachers to display their ideas to colleagues in buildings scattered across the Rockford system. Program participants and content were identified in ways that attracted a wide range of ideas about effective teaching. We avoided authoritative suggestions from central administration. Members of the needs assessment group reflected diverse viewpoints, and we followed their lead with blind disregard for the origins of peer status that program participants enjoyed.

Our heterogeneous in-service content and the voluntary conditions surrounding its use can thrive in some social structures, but not in others. The two variables--norm homogeneity and communication--permit specification of the most hospitable work cultures and those less interested in changed classroom behavior induced by collegial models from other buildings.

We expected buildings with a narrow range of work norms would be unlikely to greet our brand of in-service on cable warmly. The most straightforward explanation contains two components. Homogeneous buildings are difficult targets to hit with new ideas. We could expect lively response whenever a programmed classroom method fell within the bounds of rewarded behavior, but indifference to methods outside this agreed territory. And homogeneous buildings develop a culture of insularity that makes the very idea behind our programming suspect. We made no secret of how the diverse needs assessment group had guided our hand.

We expected buildings with diverse norms, on the other hand, to reward a range of different approaches to teaching. And we expected support for the the concept of diversity itself in these buildings, since different models of teaching are so easily observable.

Communication forms our second feature of social structure. Without i collegial supports for trying new ideas must be imagined or fantasized. Communication is the means by which the risks of experimenting with uncertain methods are minimized and trial experiences are shared. We expected communication to be positively correlated with innovativeness related to in-service on cable.

Our measures of diversity and communication draw upon an extensive gathering of data within each school and are indexed in novel ways. Findings concerning these two independent variables are interesting in themselves. Teachers were presented separate lists of staff members who worked in their building and asked for two kinds of responses.

> (Please indicate) people at your school who have especially good ideas about teaching;
>
> (Please indicate) persons you discuss teaching ideas with at least once a week.

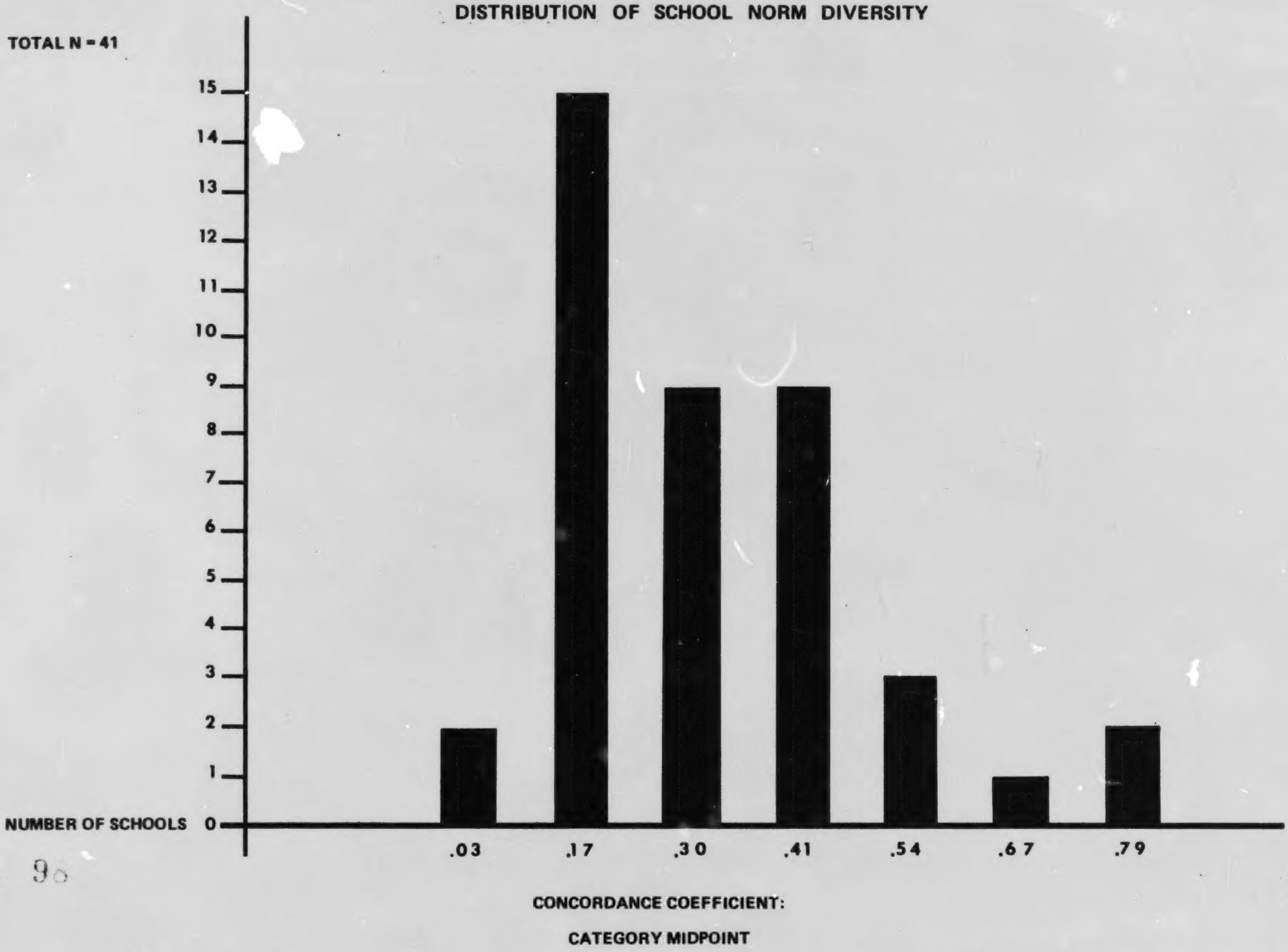
Norm diversity about good teaching performance was indexed in each building by calculating the concordance coefficient, or average rank correlation, among nominations made by all staff members interviewed. Figure 3-2 contains a histogram of these concordances for the 41 schools in the experimental design, divided into seven categories (with interval widths of approximately .13). Both the magnitude of norm agreement across buildings and the shape of the distribution convey useful information about school as workplaces.

Most buildings (the lower three categories, or 26 schools) contain staffs whose intercorrelation is less than .35. The level of statistical significance varies for buildings, of course, depending on the number of teachers interviewed. But this threshold of agreement about colleagues with good teaching ideas explains only a small amount of the variance in these judgments and suggests considerable difference of opinion, allowing a variety of role models.

The shape of distribution on norm agreement is skewed; smaller numbers of buildings are found in progressively higher categories of concordance coefficients, indicating that monolithic work environments are the exception rather than the rule. Just six buildings show levels of agreement producing intercorrelations of near .50 or greater.

FIGURE 3-2

DISTRIBUTION OF SCHOOL NORM DIVERSITY



Communication in the 41 buildings is equally skewed, and in the direction of high values. Nominations of talking partners were percentaged over a total number for each building reflecting the largest number of mentions possible, given faculty size. The histogram in Figure 3-3 shows a third or fewer talking links being used in most buildings. Only nine schools had staffs whose reports of talking about work absorbed nearly one-half or more of the interaction dyads possible.

A primitive picture of elementary schools as workplaces emerges from these data. Despite facilities for socializing, a lack of hierarchical structure, and small staffs, teachers differ widely in their definition of good performance; and they talk about work selectively with only a few colleagues. On grounds of norm heterogeneity experimental schools might be ripe for in-service on cable. But receptivity resulting from collegial social interaction seemed more remote.

Findings that bear on norm diversity and communication use rank-order correlations, separately by experimental treatment since we found skewed distributions for independent variables. The dependent variable is number of teaching ideas following our period of service delivery in experimental buildings, and Table 3-8 shows the results.

Social structure has no relationship with innovativeness in control schools where the work environment has not been disturbed with augmented communication services. Lack of correlation cannot be blamed on restricted variability; structural factors and number of ideas show variances as large as those found in experimental buildings.

By contrast, norm diversity and communication show remarkably consistent and predicted correlations with number of ideas in both sets of experimental schools. Examination of ranks reveals that the relationships are produced

AVERAGE TALKING LINKS REPORTED

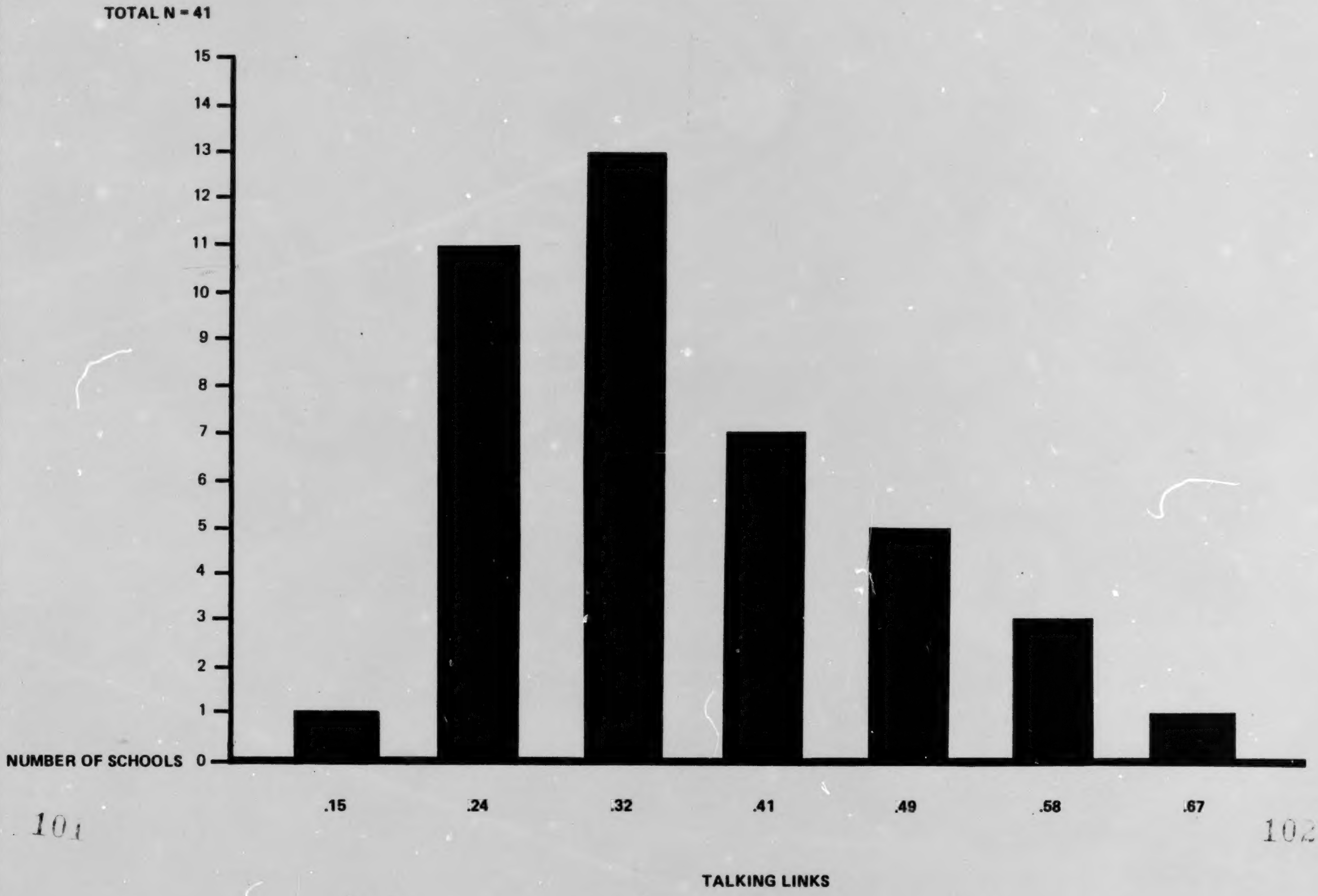


TABLE 3-8

RANK CORRELATIONS BETWEEN SOCIAL STRUCTURE AND NUMBER OF TEACHING IDEAS

Social structure:	Control	One-way	Interactive
Norm diversity	.05 (NS)	.51 (p=.05)	.53 (p=.02)
Communication	.29 (NS)	.54 (p=.05)	.58 (p=.01)
N=	15	12	14

(One-tailed probabilities shown.)

across the full range of each independent variable. As diversity of opinion about teaching role models increases, so does innovativeness. Communication among colleagues and number of ideas are similarly and positively linked.*

The magnitude of differences can be illustrated by reference to both types of experimental buildings and comparison between the lower half of schools in terms of colleague interaction with the upper half. We found an average of .82 ideas in schools with the least social interaction, hardly greater than control buildings with no in-service on cable. This contrasts with an average of 1.40 ideas in high-talk experimental schools, or a level of innovativeness that is 70 per cent greater.

A similar gap is associated with norm diversity. These aspects of social structure have practical as well as theoretical implications for the spread of new teaching ideas by telecommunication.

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*The field experimental manipulations affected neither norm diversity nor communication. This possibility was tested by comparing data from teachers interviewed with these questions before the experimental period with those interviewed afterwards--as part of the Solomon Design contolling for survey effects.

Social structure within buildings correlates with a number of satisfactions teachers derive from their work. One is naturally curious whether structure or these satisfactions predicts reaction to our television programming. This is a large topic that can be addressed only in part here.

We constructed a measure of staff morale by combining responses to two items in the interview--whether teachers would choose the same career, if given another chance, and how intensely satisfied they were with the job they presently had. Schools ranged widely in the proportion of their staffs expressing high morale using these two measures.

Potential for innovativeness correlates positively with morale in interactive schools, but not in control or one-way buildings. The correlation among interactives, however, is not as great as those observed for the structural variables. This leads us, tentatively at least, to place heavier emphasis on direct reflections of the social context to work than on more individualized expressions of work satisfaction.

Parenthetically, schools in the three treatment groups scored alike in average staff morale (measured at Wave 1), another clue that our matching of buildings yielded equivalent groups.

The equivalence of correlations between one-way and interactive buildings suggests delivery mode contains few implications for how structure accommodates the infusion of new ideas. Differences between treatments were observed in how individuals or groups viewed programs (see Social Context of Viewing, p. III-36). but these differences apparently failed to affect relationships between structure and program outcomes.

A final note concerns the two dimensions of structure. They represent empirically as well as conceptually separate ways to view work environments. They intercorrelate only modestly across the 26 experimental buildings where their influence on innovativeness can be seen. This should not surprise us. In some monolithic buildings, judged by norm diversity, teachers may talk about work widely, reinforcing their mutual agreement about the best way to teach. Staffs in other homogeneous buildings may have fallen silent years ago, lacking anything interesting or challenging to talk about. Some diverse buildings may contain several norm cliques with intense social exchange within each, while the work schedules in other diverse buildings stand in the way of extensive interaction.

Cluster analyses of norm patterns in the 41 schools disclose great variety. The same overall degree of norm diversity can be produced by a single clique surrounded by many deviants, or by several competing cliques. The importance of shape in norm diversity awaits further analysis as a predictor of responsiveness to the communication of new ideas about work.*

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*In addition to engaging a school's social structure, introduction of new communication resources presents challenges to teacher-principal relations. We studied subtle changes wrought by experimental treatments and present a portion of findings in Appendix D.

Presenting the grist of innovation, by either communication technology, encounters social structure in the workplace. Results demonstrate that the liveliness of collegial exchange and the presence of different norms for good performance lie dormant in unperturbed buildings. They fail to correlate with innovativeness except where the stimulus level of new ideas is elevated by our experimental treatments.

We cannot determine the importance of structure for other communication ventures. Those outcomes might rest on choice of communication technologies and the delivery of content that differs from ours in potential for challenging norms in school buildings. We suspect social structure to be a conditional, and not a universal factor affecting the impact of communication on the potential for worker productivity.

Viewing frequency.

We skipped over important details about project effects in order to relate main experimental findings. One missing aspect concerns program popularity and the structure of viewing behavior. We have noted the high degree of building clustering in watching, reflected by an intraclass correlation of .68 (see p. III-10). We learned more about program popularity that might assist other efforts to apply telecommunication in professional work settings.

Programs were more popular in interactive than one-way schools; 77 per cent of teachers viewed at least one show where they could participate in question-and-answer responding, compared to 62 per cent under conventional viewing conditions (difference by Chi-square based on individual teachers' behavior is significant at the .002 level).

The dynamics of viewing across time also differed as Figure 3-4 shows. It plots percentages of viewing teachers separately for interactive and one-way schools--starting with Metrics 1, the first program aired in October, and ending with the final program of the year about the use of language experience techniques.* The Figure helps draw attention to several ingredients of program popularity.

With exceptions that will be noted, the typical show attracted four out of ten teachers as voluntary viewers in interactive schools, compared to three to four out of ten in one-way buildings. Differences for most individual shows are small despite the experimental gap in total evidence already cited. The first pronounced dip in viewing occurred with program four, the show about starting Science Fair projects. This was a hastily produced effort and showed lack of careful scripting and attention to in-service goals by its uncertain use of on-camera talent and awkward editing. Word of its unappealing quality may have spread within schools, depressing the amount of viewing (we will have more to say about the effects of this one show later). It was seen in both one-way and interactive buildings just after the Christmas break; this timing as classes resumed may also be responsible for low viewing.+

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* Program viewing was measured during the second interview by a combination of unaided and aided recall methods. Three of the shows had been aired five to six months earlier and might have been difficult to distinguish without the use of both measurement techniques.

Teachers were first asked a free-recall question about viewing "in-service programs on television" shown during the school year, and then were presented with a list. The two kinds of responses were highly correlated, although the major share of data describing viewing was provided by the free-recall question.

+Some of the depressed viewing in interactive schools may have resulted from the equipment malfunction described on p. I-3, which occurred during delivery of Science Fair.

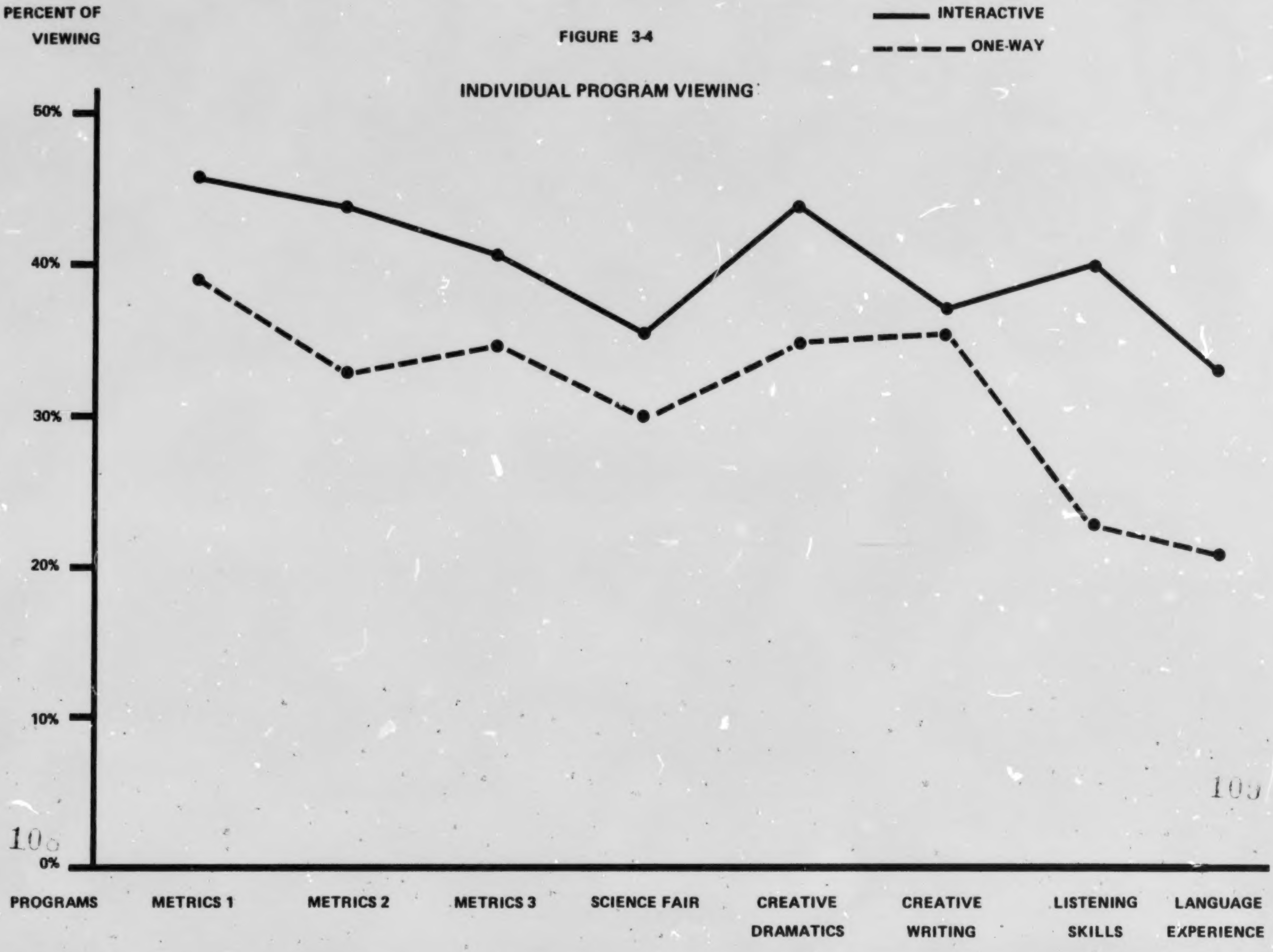

FIGURE 3-4

INDIVIDUAL PROGRAM VIEWING

Watching in-service rebounded to customary levels later in January with the onset of programs about language arts topics, the first dealing with the use of creative dramatics in the classroom. Viewing levels continued steady in both types of schools through the next program about creative writing projects. At that point interactive and one-way teachers digressed. In one-way schools viewing fell off sharply; interest remained at the customary level for another program in interactive schools, and then declined as the final show was aired in the crowded and hectic end-of-year period.*

The percentages showing program popularity fail to confirm our initial fears that interactive service would demonstrate a novelty effect, quickly dissipated over time. Instead of a wide advantage in interactive over one-way audience size at the start and a narrowing thereafter, viewing trends in Figure 3-4 are largely parallel.

Some decay occurs in both interactive and one-way program viewing across time. We are inclined to attribute this to the appeal each program had and to competition for time from other school obligations, rather than to a general fatigue. Note that viewership of the sixth show is only nine points less than the first program among interactive teachers and just three points less in one-way buildings

This examination of gross audience size points to treatment differences. But a closer look at the data is required to detect patterns of viewing behavior, and in this respect teachers in the two types of schools were similar.

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*In a quickly executed telephone survey in early January 1978, which included teachers from control, one-way, and interactive schools (N=150), we asked respondents about their feelings regarding the programming and other issues. We were also interested in the rank ordering of interest in topics of the four upcoming language arts shows. Had we known the preferences of this small sample early enough to schedule the programs accordingly we would have led off the new series with the most popular topic, creative writing, rather than the less interesting subject, creative dramatics. In any case, it is no great surprise that viewing of the last program, Language Experience, is quite low. Not only did it come at a busy time, but its subject area also rated poorly in popularity.

Correlations were examined in viewing, program by program, using factor analysis to discern clusters of shows that may have attracted a common audience.* The statistical procedures did not presume any set number of program types, nor that any program types that might be discovered would be independent of one another.

In both one-way and interactive schools we find comparable viewing patterns, suggesting that different modes of delivery do not influence how program content is perceived. Two factors emerge in both sets of schools. The three metric programs appear as strong ingredients of one factor, and the four language arts shows load heavily on the second. The show about Science Fair projects is a unique case, but it belongs more to the language group than the math cluster--perhaps because it was intended to encourage non-quantitative teachers to get their students involved with easily supervised scientific activities.

Although factor clusters are found to be related to program content, numerical size of loadings (not shown here) should be kept in perspective. In both types of schools the factors correlated highly (around .60), which confirms that many teachers watched in-service programs that varied considerably in their formal content or avoided in-service regardless of content shown.

These results concerning program viewing bear on the use of telecommunication. Production decisions in our project took careful note of clients' wishes. Program topics were identified by a thorough and representative consulting process. Judgments about other program ingredients flowed from the advice we received. That we observe fluctuations in program popularity and distinct, content-related factors in viewing preferences confirms the advisability of taking account of teachers' expressed information needs about in-service.

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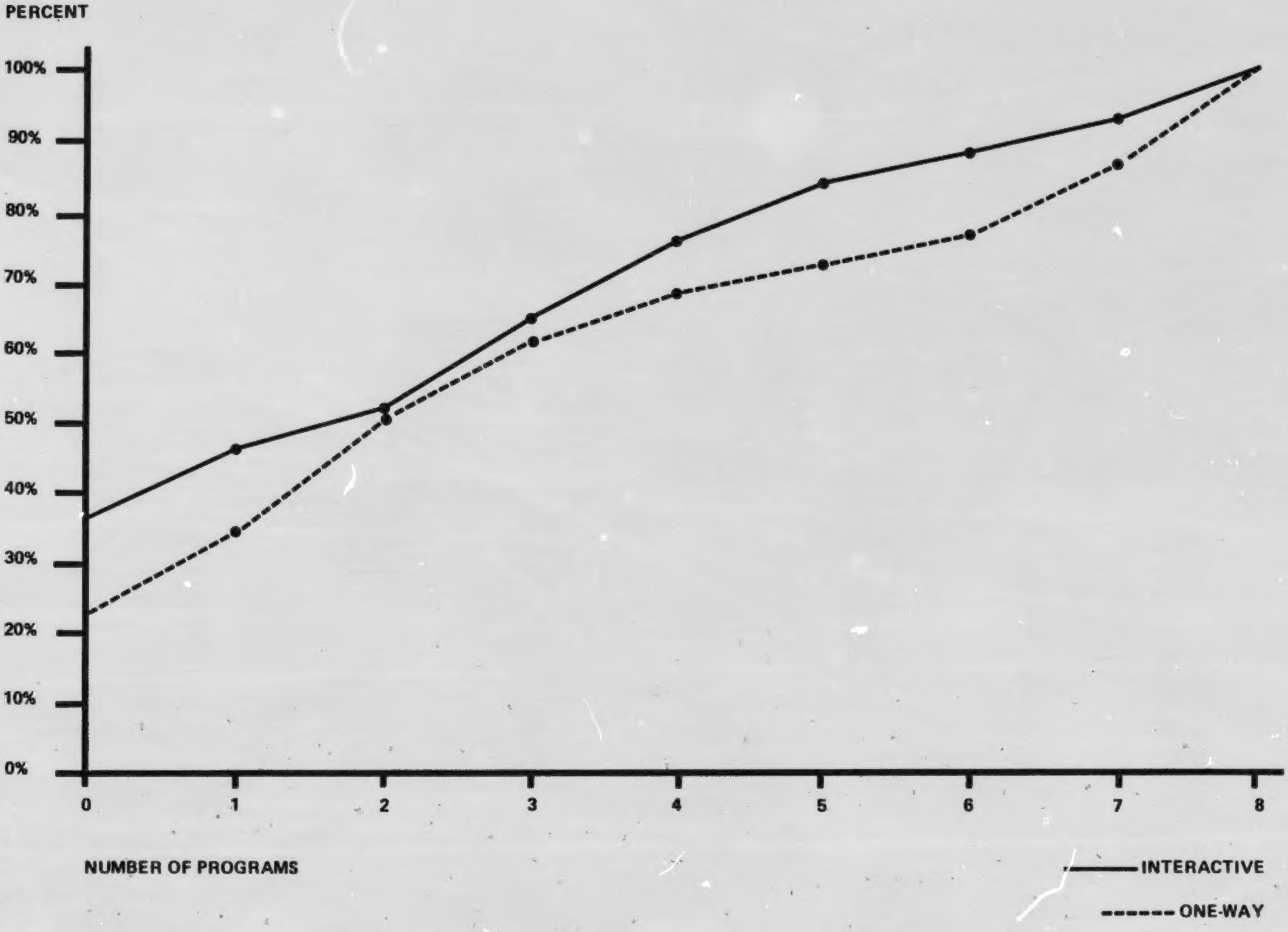
*Correlation coefficients are Tau-Bs. The factor analytic procedure used a principal components solution and oblique rotation by Promax. The eigen values obtained and variances explained are alike in one-way and interactive conditions.

CUMULATIVE PROGRAM VIEWING



But in the final analysis, fluctuations and clustering seem modest compared to evidence suggesting uniformities of interest in in-service on cable. The large correlation between content factors has already been cited. More particular instances of uniformity can be found in individual viewing correlations. The popularity of Metrics 3, for example, correlates about as highly with the show on creative writing as either program correlates with its content mates. Other cross-content viewing correlations are uniformly large.

In short, our use of telecommunication for in-service tended to draw a single audience, supplemented by smaller, additional audiences attracted to particular program themes. Figure 3-5 presents cumulative distributions of program viewing--showing that the typical teacher watched two shows. More than one out of five interactive teachers watched all or nearly all of the eight programs; the number of "fans" of in-service on cable was less than half that level in one-way schools.

Repeat viewing of programs was not uncommon, an outcome we had hoped to encourage by our scheduling policy. One out of four viewing teachers reported he or she had watched some of the shows more than once, an event that happened with equal frequency in one-way and interactive buildings. This is reassuring since we had feared that one-way teachers with their program presentations clustered after school might be blocked from multiple exposure, compared to interactive buildings where programs could be viewed throughout the day. No single program was especially favored by multiple viewing.

To summarize, interactive cable garners a larger and more intensive audience than conventional, one-way delivery. But program preferences in the two conditions assume a common shape. By and large teachers view or avoid in-service as a general product; differences in content are fine-tuning by comparison.

Social context of viewing.

One benefit of interactive delivery we envisioned for improving professional work productivity is privacy. Continuous program delivery throughout the day linked with an individualized response device, all available in a designated room, should disarm fears among some teachers that participating in in-service can be threatening.* These threats arise from potential--if covert--surveillance by the principal and risks of self-disclosure to colleagues.

We questioned teachers about their attendance at conventional in-service staff meetings, and their replies sustained our belief in the advantages of interactive response to television. Few teachers reported they had anything to say during typical staff in-service meetings, even though these gatherings include from eight to around 25 persons. We attached some importance, therefore, to studying the viewing situation during cable delivery in one-way and interactive buildings.

Characteristics of this situation would arise naturally, we felt, since viewing was clearly voluntary. We went to some lengths in both treatments to discourage principals from making our service an obligation or part of required activities.

To our surprise--and despite the strain of incompatible work schedules--a large number of viewers reported they usually watched in-service with at least one other person. Sixty-three per cent claimed group viewing as typical; 26 per cent said they usually viewed alone, and the remainder said solo and group viewing occurred about equally.

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*Program schedules differed in one-way and interactive schools, but without consequence for access to programming. Although interactive presentation continued throughout the day, whereas one-way delivery was confined to before and after school, close monitoring of logging in by interactive teachers disclosed that almost all their viewing occurred before and after classes each day. Viewing was light on Fridays, compared to other week days.

We were surprised again to find no differences in social context between one-way and interactive schools. Using a terminal might seem awkward with more than one person in the room. But our field staff observed this was commonplace.

Two additional questions shed direct light on social correlates of viewing. Following that we will examine social perceptions among teachers more closely. We asked whether anyone had "encouraged you" to watch in-service on cable. Half of the teachers, including non-viewers, attributed suggestions to their building principals and another quarter mentioned our project aid, a frequent visitor to all schools. There were no differences by experimental treatment.

It is important to observe that these pressures, where exerted, seem not to have affected teachers. While buildings varied widely in the number of staff who reported their principals had urged them to view, there is no correlation between these encouragements and viewing, nor with number of new teaching ideas.

Effects achieved by in-service on cable do not rest on the most obvious authoritative sanctions--at least in the voluntary atmosphere we sought to create.

But there was a difference in frequency of colleague encouragement, more of this occurring in interactive schools. This is consistent with data gathered from the majority of teachers usually viewing with others, whom we quizzed about the origins of their groups. We wanted to know if people got together as a planned staff meeting (under the principal's authoritative guidance), if viewing groups of two or more were personally arranged, or if people came together some other way, typically by accident. Group origins differed, as Table 3-9 makes clear.

TABLE 3-9

GROUP ORIGINS OF SOCIAL VIEWING CONTEXTS

Usual origins of group:	Among Group Viewers Only One-way	 Interactive
Staff meeting	27%	14%
Personally arranged	30	73
Other way	43	13
	100%	100%

(Chi-square= 28.7; $p < .001$.)

Interactive group viewers took the initiative in setting up the circumstances of their watching in-service on cable. Observational reports disclose that social viewing was comforting, reducing apprehensions about keying responses to program material, and that the presence of others turned interactive viewing into an entertaining experience. Teachers chatted about the "best" answer to give during the shows and traded reactions to programmed feedback afterward. Group responding in interactive schools reduced the validity of opinion feedback, of course, although gratifications provided by feedback may not have been weakened. Unfortunately we have no data on this point. By contrast, at one-way schools the bulk of viewing in groups occurred as part of staff meetings (despite our wishes otherwise) or happened by chance.

Perceptions of others' viewing.

Viewing in-service acquired different degrees of social visibility in the two experimental treatments, affirming the greater collegial involvement in interactive schools scheduling group meetings and encouraging others to watch. We asked teachers how many of the programs they thought others in their building had watched, and assigned a score to each school representing the proportion who felt colleagues had viewed "most" or "some" of the shows, on average.

Perceived viewing was greater in interactive schools than one-way buildings (p = .07, one-tailed). But more to the point, perception matches reality more closely in interactive schools than in the one-way condition. The correlation between perceived and actual viewing levels equals .56 (p = .05) where standard television was shown. The relationship is greater--.82 (p = .001)--in the interactive condition.

More penetrating analysis assures us that the dissemination of new classroom ideas did not depend directly on perceptions of others' viewing; number of ideas correlates with viewing of programs, not with awareness of viewing by colleagues.

These results weaken, even negate the presumptuous importance we placed on privacy in using cabled in-service. Teachers want to use this material in a social setting. More critically, they plan social viewing where interactive service is available and recommend programs to others.

Use of cabled in-service becomes shared experience to a greater degree in interactive buildings. While this sharing has no direct effect on innovativeness, it is certainly an advantage, increasing viewership and incorporating cable as part of peer group life to a degree not attained with conventional television. Whether this advantage associated with the newer technology would persist beyond its introductory, or novelty phase cannot be determined in the present study.

Offers of supplementary teaching aids.

Mass media are sometimes thought to be impersonal instruments whose content is manipulated by distant and unknown people. Our project took pains to disarm these sentiments by developing an audience-centered philosophy guiding production of programs and, importantly, by offering a personalized, interactive delivery to one set of experimental schools. We were sensitive, though, to how rudimentary our interactive algorithm was and to possibilities we might fail to construct in-service units that teachers could apply to their work.

The needs assessment committee was also keenly aware of the formality of television, compared to in-person staff development, as a means of conveying innovations in vivid and applicable ways. They and we worried over a potential lack of connective tissue binding what was seen on cable to the daily problems teachers face. How might our audience, we asked, be assisted in executing the ideas we presented on screen? Were there supplementary resources we could provide that would sustain this connective process?

The advisory panel came up with a recommended solution. For each program we should assemble materials--teaching aids, workbooks, a supplementary text, or other items pertinent to content and goals--that would ease teachers through the steps of applying in-service. Materials should lend themselves to individualized use, in keeping with the spirit of our client-centered approach. But they should reduce the uncertainty or difficulty surrounding use of programmed ideas in meeting classroom demands.

We placed another requirement on supplementary materials. They should be inexpensive, obtained where possible from sources within the Rockford schools. The committee agreed.

With their counsel and advice from program participants we assembled kits for each show. Each program's host concluded the unit by describing our offer and reminding viewers how they could obtain it. A collection of metric measurement tools enabled viewers of the first programs to practice what they observed other teachers learning; the program's host drew attention to the benefits of imitative learning as she worked with four elementary teachers mastering the metric system in our televised presentation.

The offer in Metric 3 contained games and worksheets shown in the program, plus a variety of other aids that had been assembled by a Rockford teachers' summer workshop the year before. For the Science Fair show we contacted a national association of science teachers and adopted a kit they had assembled containing motivational aids, posters and project ideas. With creative writing we provided project ideas and other assists that program participants had found beneficial in their classes at several grade levels. A similar package was produced for the listening skills show. A popular paperback book dealing with creative dramatics in different curricular settings was purchased for that program. And for our final show on language experience we borrowed a highly touted workbook of application exercises that two enterprising Rockford teachers had developed the year before in hopes of interesting a commercial publisher.

Thus, free materials offered at the conclusion of each program varied widely in content and form. Each set was judged appealing by teachers shown in the program, who expected viewers to be especially grateful for the supplement since the school system had lately been stripped of budget for books, paper, ditto masters and other common tools of classroom work. We would be overwhelmed by the number of requests, they warned.

Interactive cable offers particular advantages in coping with brisk demand. We programmed the computer to allow viewers to order materials using their terminal. Following the opportunity to enter this signal, 14 brief displays headed by each school's name were flashed to interactive buildings listing the staff who had ordered materials to date. Given our advisers' confident predictions we expected displays to provide bandwagon support for our offers--and indirectly to encourage application of programmed ideas in classrooms.

Teachers in one-way buildings were forced to use more conventional means to order materials. Their cable program host alerted viewers to stamped, addressed post cards we had left in the school office. In both interactive and one-way conditions, our project assistant responded to orders by hand delivering packages within a day or two of observing a signaled request on cable or receiving the postcard through the mail.

The materials offer provides quite a different kind of outcome that might be affected by technologies of program delivery. We recognized that these supplements elaborated the experimental stimuli, adding to the already complex set of ingredients to which any telecommunication effects might be attributed. But teachers' ordering would give us an immediate, behavioral indicator of each program's usefulness. And, we thought, the offers yielded opportunities to gauge the validity of questionnaire data. We would ask teachers in interviews whether they had requested our materials, but also maintain independent records for cross-checking.

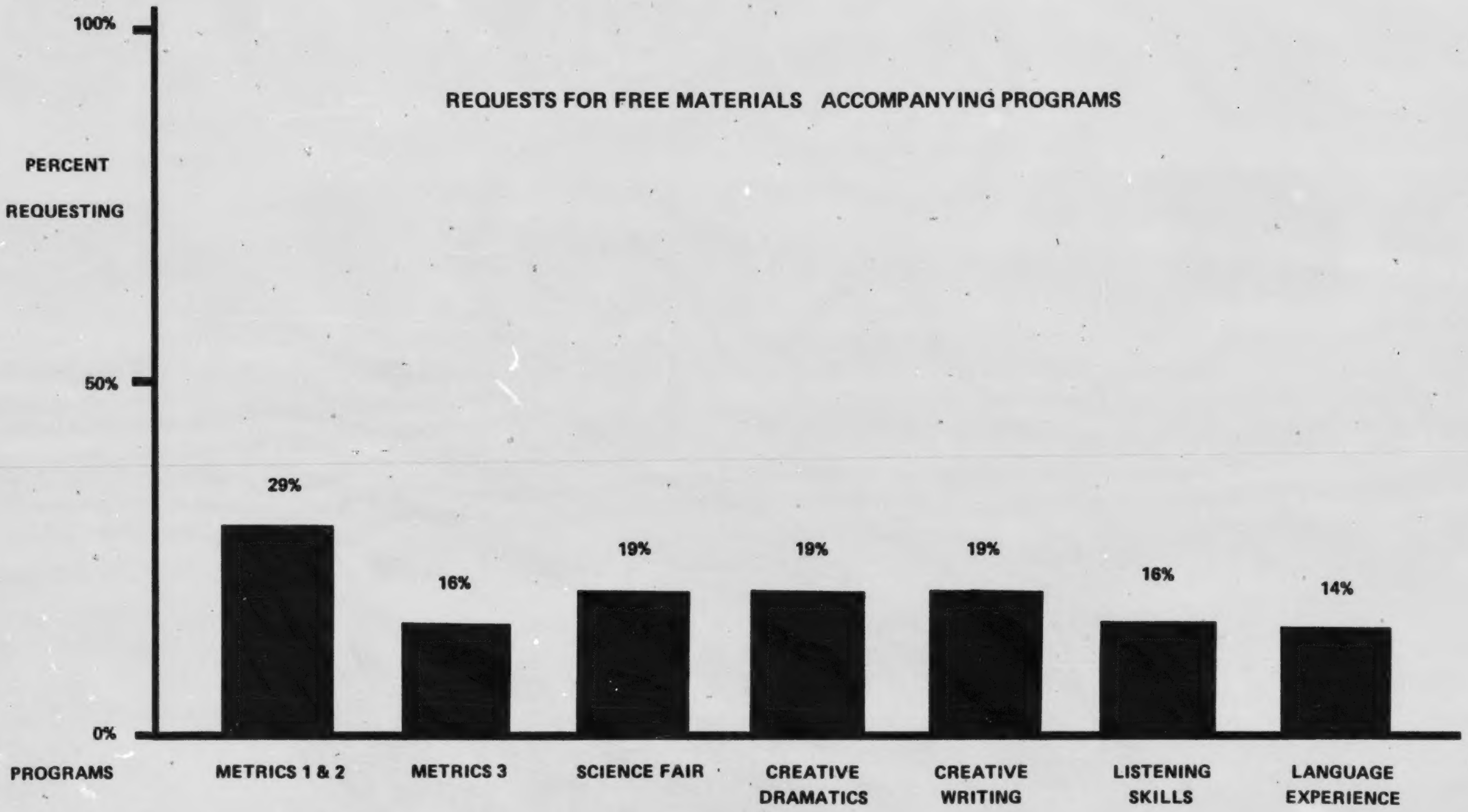
Two surprises foiled the validity check. Many of the teachers requesting kits passed them on to colleagues. Or one member of a viewing group, in either type of school, would take responsibility for ordering the materials; in interactive schools this was the individual who had logged onto the system for viewing. When our project assistant appeared, packages in hand, she was often greeted with additional requests.

In one-way schools postcards were used by some teachers who had not watched the program. There was no graceful way to impose a viewing test before distributing supplements. Nor could our questionnaire distinguish reports of receiving materials from reports of requesting them. The results we now analyze are based on interview responses.

Results are presented in Figure 3-6, showing percentages of teachers obtaining materials associated with each program. The first two shows, Metrics 1 and 2, have been combined since the same kit of teaching items (a place-value chart, liter cube, weights, etc.) was used for both.

Rate of response is remarkably consistent across programs, despite their diversity in content and wide differences in type of teaching tools made available. This lack of variance contrasts with considerable variability in program viewing noted in Figure 3-4. And response to our offers is meager; about one teacher out of six came in contact with each set of supplements.

FIGURE 3-6


REQUESTS FOR FREE MATERIALS ACCOMPANYING PROGRAMS
100%
PERCENT
REQUESTING
50%
0%
29%
16%
19%
19%
19%
16%
14%
PROGRAMS
METRICS 1 & 2
METRICS 3
SCIENCE FAIR
CREATIVE DRAMATICS
CREATIVE WRITING
LISTENING SKILLS
LANGUAGE EXPERIENCE

Consistency in requesting materials is confirmed by intercorrelations across the seven offers. Coefficients are uniformly large and yield only a single factor (by principal components method) with an eigen value greater than 1.0. A small band of materials - conscious teachers sought as many of the items as they could, which permits summing all uses into a single measure for further study.

We found average response to the offers equal in the two experimental conditions. There is no reason to infer that differences in communication technology encouraged or inhibited getting packets of materials.

This null finding is equivocal in several respects. Our comparison of conventional and interactive cable confounds several of their features--viewing experience, self-disclosure in ordering materials and other ingredients. We have confessed inability to distinguish between teachers who ordered materials from those to whom they were passed. But we should take another step beyond the finding to settle a nagging possibility concerning main experimental effects indexed in the number of new ideas stimulated by in-service on cable.

It is conceivable that new teaching ideas were diffused mostly by the printed classroom aids, which were produced at a fraction of the cost of developing the interactive cable system! Were this the case, all that could be claimed for telecommunication in the present experiment is that it performed an interesting (if unusual) service, drawing teachers' attention to some booklets, graphic aids, work sheets and other handy tools for helping children learn.

Experimental evidence about the effects of cable appears to be immune from this possibility of contamination, however. In fact, main experimental results are even more robust in light of the relationship between average number of requests obtained in each school and mean teaching ideas. For this test we have used the most exacting measure of new ideas and methods--the three content areas most clearly emphasized in program content and reinforced by free materials (see p. III-19).

Schools with teachers who sent for many of our materials actually have lower means for number of ideas than schools where teachers ignored our offers. The overall correlation in experimental schools (26 buildings) is -.26.

Close inspection of the scatter plot reveals one building of the 26 that departs markedly from the generally negative relationship. With this single outlying school removed, the negative correlation between obtaining free materials and having teaching ideas attains statistical significance (by two-tailed test); the coefficient equals -.44, $p < .05$.

This remarkable and unexpected result deserves elaboration in light of the earlier data about response to the free offers. Recall that the materials teachers might receive were described--for the most--as items other teachers in Rockford had crafted. They grew out of colleagues' experiences in the classroom and were, in this sense, "user certified," much like the content presented on television.

All our observations and testimony by informants agreed that elementary teachers were starved for the aids we offered: Metric kits, a widely acclaimed book about creative dramatics, games and motivating activities in language arts, work sheets and ditto masters in listening skills, a locally written plan of action for using the language experience approach, and others.

The popularity of this rich assembly of offerings seems staggeringly modest. In six of 26 experimental buildings not a single teacher responded to any of the offers. Overall, only 38 per cent of teachers obtained even one set of materials; Figure 3-6 shows the low response rate for each of the opportunities.

The negative relationship with number of ideas suggests at least three explanations. To the degree in-service on cable succeeded in conveying new ideas, it may have freed teachers from a need for the supplementary items we thought they would find helpful. Perhaps the low number of requests should be read as an unanticipated achievement rendered by in-service on cable.

Or, teachers may simply possess a finite capacity to process information about their work and how to do it differently. Once they have consumed a body of information from whatever source (cable television in our experiment), their appetite for more wanes. In this view, if we had started by distributing free printed materials, we might have suppressed inclinations to view in-service on cable later.

Or, the kind of workbooks we offered may serve as crutches for teachers who generally lack ideas, whereas innovative teachers prefer to invent their own aids.

We should read the results bearing on free materials as mixed. At best, the distribution was immune to experimental increase from interactive telecommunication. Use of the materials may actually constitute a counter-effect. In any event, the spread of innovative ideas from in-service can be attributed clearly to cable program content, and not the supplementary offer.

In summary, the offers' lack of appeal simplifies future applications of interactive telecommunication. It is hard to argue from these results that telecommunication services for professional groups like teachers depend for their benefits on generating an additional information system using conventional print.

Perhaps flashier and more costly supplementary information could be developed and used experimentally with different effect. But to merit adoption, distribution would need to overcome both the low response rate and negative correlation with new ideas evident in our data.

A classroom effect from cabled in-service.

While confessing a general inability to look beyond teachers' reported innovations, our field experiment provided one opportunity to examine classroom impact directly. The test is particularly demanding because it explores whether any achievements flowed from the spontaneously produced show about Science Fair projects.

Recall that, in our view at least, its artistic merits were negligible. In the jargon of the television trade, it was almost all "talking heads"--teachers explaining their ideas directly to camera or through the thin artiface of an interview conducted by a colleague. Participants were sincere and effective teachers in their own classrooms; but they had not planned their remarks carefully. Some were awkward before camera. Exhibits of science projects used to demonstrate the range of possible entries were crudely lit and difficult to see on screen. The program lasted a brief 13 minutes.

Its failure in a producer's eyes was frankly the producer's fault. The Michigan group wanted to attempt at least one quick response to expressions of in-service interests arising from clients during the course of our field experiment. Our investment of time in scripting and program design was meager.

We also saw the show as an opportunity to let Rockford audio-visual staff try their hand at producing in-service programs with their own equipment which included one set of lights, a color camera and tripod, and a standard three-quarter inch videotape recorder, as well as two lavalier microphones, and a microphone mixer. Videotaping occupied only three hours one morning, using a spare room turned into a set. The program was assembled on Michigan's Convergence editor, a crucial technical asset that permitted salvaging a much more coherent product than could have been attained with less sophisticated small-format equipment.

When the show aired during the busy back-to-school weeks in early January, it attracted a small audience, as we related on p. III-32. But still, did it make a dent in the low rate of Science Fair activity that had prompted a science education committee to seek our help?

The best measure for generality of effects examines the level of science project activity in each of the schools before entries were winnowed for submission to the city-wide Fair. This choice of variables parallels the difference between intramural and varsity athletics: The first taps an interest in sports, while the second reflects competitiveness and inter-school rivalries as well. The program's airing was timed to excite intra-building activities leading to local classroom displays that parents visit, from which entries for the city contest would be selected.

All but one of the schools (an interactive building) maintained records of science projects constructed following our period of in-service delivery. We found these accounts expressed in round numbers, rather than precisely, which recommended a cautious application of statistical test for significance of differences. Table 3-10 shows median number of projects in each treatment group along with contrasts of interest. A Kruskal-Wallis analysis of variance among all groups revealed differences significant at the .12 level (one-tailed); but the comparison of control schools with interactive schools (using the Mann-Whitney U test) was significant by both statistical and subjective standards ($p = .05$ one-tailed).

Teachers and students worked on twice as many science projects in interactive schools as in one-way buildings, and better than three times as many as control schools.

These are differences one might sense by strolling through school halls, equally as well as by conducting painstaking social research. There were no science projects at all in a third of the control buildings, a record justifying the discouraged request for assistance we heeded. Only three of the 25 experimental buildings lacked at least some activity; eight of the 13 interactive schools that maintained accounts fielded 100 or more projects.

TABLE 3-10

MEDIAN NUMBER OF SCIENCE PROJECTS

	Control	One-way	Interactive
	28	52	100
N=	15	12	13

Control vs. interactive	p=.05	(one-tailed)
Control vs. one-way	p=.21	(one-tailed)
One-way vs. interactive	p=.19	(one-tailed)

It is difficult to escape concluding that in-service on cable helped, especially the interactive version that drew attention to key steps that contribute to educationally successful projects. The lessons we can learn include unsuspected value that can be wrought from even crude television productions--if they touch topics of vital interest. And we should be alerted to pass-along benefits. Programs that gain small primary audiences may reap additional rewards from word-of-mouth. secondary exposure to ideas. We lack direct measurement of such a flow in science project ideas. But the interpretation coincides with other observations we have made from data about social structure within schools--and with the apparent gap between number of viewers (roughly one-third in both types of experimental schools) and the large difference between one-ways and interactives in number of projects.

Learning from in-service on cable.

Our analysis of telecommunication effects has centered on the shape and content of teachers' classroom activities. Absent has been any recognition that what professionals know--in a cognitive sense--contributes to work effectiveness. Knowledge is a particularly vital concept in the life of educators, since their most obvious function is to impart information to others.*

At the start of this excursion into data, we should be reminded that most of our televised in-service skirted questions of increasing viewers' information about instructional content. On the advice of the needs committee, we concentrated on conveying different ways to present content in the classroom. The one consciously recognized exception to this rule concerned metrics. In that area we were told viewers would need help gaining mastery over basic terms and connections among linear, weight, volume and temperature measurement.

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*We will not digress to worry over the many processes implied by the verb "impart."

We have already related how programs were produced to satisfy this demand; the first two metric shows were preoccupied with teaching cognitive material, while the third turned to our more familiar theme of innovative and effective classroom activities. At two points in our surveys measuring telecommunication effects we sought to capture how successful we had been in reaching cognitive goals with conventional and interactive television.

The first reading was part of a telephone interview with 150 randomly selected teachers drawn from all participating schools; they were contacted in January--the mid-point of service delivery and just following the airing of metric shows. The interview's purposes included a quick check on the perceived benefits of programming, as far as it had gone; we asked for the following subjective appraisals:

> Let's think back to the start of this school year, that is September, 1977. I am going to read you a list. For each item, please tell me how familiar you were with each topic at the start of the school year.
>
> Linear measurement and temperature in metrics
>
> Weight and volume measurement in metrics
>
> Classroom activities for teaching metrics and measurement
>
> Now, let's go through the list again. This time I would like you to tell me how familiar you feel now about each of the topics.

A crude familiarity scale was used--including very familiar, somewhat and not very familiar, and we accepted "don't know" responses. We must recognize limitations in this kind of data, including the respondent's need to identify what is meant by "linear measurement," "weight and volume," "classroom activities" and the other terms before providing a coherent response quickly over the telephone. Equally serious are difficulties in relating the concept of familiarity to actual cognitions or understandings held about the topics.

But with these cautions in mind, it is instructive to look at subjective gains in metric familiarity--comparing teachers in one-way and interactive buildings. We focus on just those teachers who reported viewing metric programs pertinent to each dimension of subjective familiarity. The results are simple and provocative. On the two cognitive dimensions of measurement skills, where a team of teachers had been televised with Rose Chaon demonstrating the application of metric concepts, subjective gains in understanding are quite modest. For both topics gain scores average near .20 of a point on the familiarity response scale.

Of course, how much a teacher might gain depends on how familiar he or she felt before programming; approximately 70 per cent thought of themselves as "somewhat or very familiar" with each topic before the school year, which leaves our analysis with a sizeable group who don't have much scale room for improvement.

When we compared one-way and interactive teachers, no differences could be detected in improved familiarity.

The story is much different for the third programming area where classroom activities were shown. This television content instructs by visually presenting patterns of action--the modeling of children's classroom behavior and their exchanges with teachers. This contrasts sharply with cognitive information about metrics, which is largely verbal even when encased in a visual format.

The subjective gain in familiarity with activities is shown by the following means for teachers in one-way and interactive buildings:

	one-way	interactive	
Mean gain score for classroom activities	+.15	+.44	Difference: $p < .02$

Based on teachers' impressions, people with interactive service gained more than those exposed to one-way programming.

For many reasons, some already cited, these are soft data that do not deserve much emphasis. (We will present more substantial data about cognitive learning shortly.) The present results are consistent, we suspect, with an attitude that may be common among users of telecommunication for improving work productivity. The medium's principal strength is thought to be in the display of shapes and colors and sequential motion. Relationships among shape, color and time are the unique province of visual communication. An especially vivid communication experience can be achieved where the sound track is used to reinforce relationships involving shape, color and time.

Many people expect that using television to teach verbally-anchored concepts robs the medium of its power, except as an attention-getting device. Attention is not enough to insure learning. Viewers' attitudes about the greater suitability of television for imparting visual, rather than verbal material is suggested by our discovery of a significant different between one-way and interactive technology where primarily visual learning is taking place, contrasted against no differences where the criterion for success is grasp of verbal concepts.

We turn now to a more carefully constructed look at knowledge about metrics in our project's schools.

Assessment of how well teachers understood metrics awaited the post-delivery interviews in spring, when questioning could yield more dependable data than a quick telephone survey. Delay in measurement was a significant concession; decay in telecommunication effects over time could blunt comparisons between delivery modes. Also troublesome was the possibility of intervening events that could disturb contrasts between control and experimental schools.

We asked four factual questions using a self-administered handout given respondents toward the end of the spring interview. They were asked to circle one of four answers for each of the following items:

How many milliliters are there in a liter?

The boiling point of water in Centigrade degrees is. . .

Metric weight or mass is measured in. . . (types of units)

A liter is equal to a cubic. . . (measurement scale in metrics)

Greater effort in designing a factual test would certainly have produced a wider-ranging measure that was more technically sound. But findings are at least suggestive and are consistent in the main with other differences we have observed comparing conventional and interactive cable. Analytic details about the four items provide a transition to presentation of central findings.

Building averages in correct responses to the items immediately disclosed sharp differences in level of difficulty. In the average school--control or experimental--61 per cent of teachers got the first item right (1,000 milliliters), 65 per cent knew the second (100 degrees), 84 per cent knew the third (grams), and a slender 27 per cent had learned that "a liter is equal to a cubic decimeter."

Intercorrelations among items showed a large coefficient between questions two and three ($r = .55$, based on building-level data), one that is greater than other relationships (items one and four correlated at .37, for example). On reflection we were struck with how much more familiar people might be with the centigrade scale and with weight measurement, as an outgrowth of listening to weather forecasts and grocery shopping. Volume measurement, on the other hand, is relatively novel; certainly our teachers found the questions more difficult to answer.

Accordingly, we designed a more rigorous assessment of telecommunication effects than originally planned. We wondered if knowledge about metrics that was least common among teachers would show experimental treatment differences. Looking at responses to items one and four, treatment differences show a large and statistically significant gap between building averages in one-way and interactive schools ($p = .03$). Perversely, however, control schools are in the middle--more knowledgeable than one-way buildings but less than interactives.

To sharpen the analysis further, we used regression analysis to obtain residual knowledge on the difficult items, controlling for metric knowledge measured by the easier questions about familiar topics. Table 3-11 shows results.

Teachers in interactive buildings have dramatically higher levels of metric knowledge than their counterparts in one-way schools. And interactives are better than controls. The one cloud over these findings is obvious; control schools scored in the middle, as the less rigorous comparison reported above showed.

In the absence of clarifying data, one could blame a variety of factors for this confusion. Perhaps the treatment groups were not equal in metric knowledge at the start of the experiment; we have no way of knowing now. Or, increased conventional in-service in control schools during the year (see pp. III-13 for more details about these activities) may have stimulated metric knowledge, even though sessions did not deal with metrics directly.

TABLE 3-11

MEAN RESIDUALS FOR METRIC KNOWLEDGE BASED ON DIFFICULT QUESTIONS BY EXPERIMENTAL TREATMENT (VALUES ARE STANDARD SCORES)

	Control	One-way	Interactive
	-.06	-.50	.49
N=	14	12	13

Control vs. one-way: Result opposite than predicted
Control vs. interactive: $p = .02$ (one-tailed)
One-way vs. interactive: $p = .0001$ (one-tailed)

Note: One control school and another interactive building have been eliminated following an outlyer analysis identifying cases (schools) more than two standard deviations from the mean for all buildings. Each eliminated case had abnormally low rates for interview completion.

A tempting post-hoc interpretation would imagine that control schools are near zero for the best of technical and substantive reasons; that one-way buildings show depressed levels of knowledge because one-way television is a confusing way to present verbal information; and that interactive delivery overcame the limitations of standard television by reinforcing the learning of new material.* Unfortunately, we lack appropriate data for confirming or challenging this reconstruction.

It may not be quite such a strain to reconcile hard results about what teachers know with soft data about subjective estimates of learning. The easy difference is to be found in the contrast between attitudes and behavior. A more relevant point can be drawn by suggesting that visible telecommunication effects need to be passed through an analytic prism more refractive than descriptions of impact upon self. These descriptions are valuable for what they say about teachers' willingness to use television for different purposes, or about the perceived suitability of audio-visual signals to convey information. But they do not disclose the potential of new telecommunication media.

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*Corollary to this, lower values in one-way schools may have resulted from rapid decay of imparted information where response reinforcement was absent, compared to the interactive treatment where overt responses were invited.

Chapter 4

CONTINUED USE

Throughout, staff conducting this experiment have been conscious of a distressing feature common to most demonstration projects. Regardless of their attainments, processes set in motion rarely continue past the period of initial funding. This is especially true of field experiments structured like ours: A distant University collaborating with previously unknown people, introducing an utterly novel institutional activity. Ann Arbor and Rockford are 315 miles apart in non-contiguous states. No institutional ties bind The University of Michigan and either of our participating organizations on site, Rockford Schools or the cable franchise operator. A commitment to produce and distribute indigenous television programming for professional development lies well outside customary functions undertaken by the school system's central administration.

Our project was not budgeted to maintain a local project coordinator; all activities were accomplished through travel and short visits squeezed into normal academic schedules sustained by the principal investigator and his faculty and graduate student colleagues.* Telephone contacts kept communication alive at vital points, but this link was sometimes only marginally useful. The workday schedules of public school teachers and administrators differ vastly from those of academics, a barrier complicated by separation in time zone. Goodwill and enthusiasm for the project at both locations helped bridge, but could not elimate these structural difficulties.

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*Travel requires a half-hour airport commute, one hour plane ride, 30-45 minutes to arrange a rental car, and another 75 minute drive to reach Rockford. Project staff often arrived at their destination after 10 p.m., having departed following classes in Ann Arbor, to down a franchise hamburger (restaurants close their kitchens around 8) before retiring.

We searched for ways to improve the experiment's chances for continuation--if it should improve prospects for classroom innovation. Some of these have already been touched upon. Processes of needs assessment were kept simple, if comprehensive. Our questionnaire and resulting committee structure can easily and inexpensively be duplicated, with one proviso. That refers to the political implications for authority that convening a panel like ours represents. The group worked well for us, but we were outsiders and transients. Can such a committee--elected, in effect through a process of data collection--be accepted by school administrators? Would a central authority create the panel as we did, promising to heed its recommendations and allocate substantial sums of money and staff time in response? These are questions various educational bureaucracies might answer differently.

Other parts of our Client-Centered Production System pose thorny challenges to conventional management routines. The identification of peer-nominated program participants can lead to mavericks as well as teachers who enjoy administrators' blessings. We commenced our work with the advantage of ignorance about clique structure in the schools. Of course, ties of friendship and collegial regard characterize all organizations, and we were quick to sense their dimensions in Rockford. We feigned a lack of awareness as long as possible, enabling us to select some program participants who might not have survived a politically sensitive process.

We think we understand who the insiders and outsiders were. We are frankly undecided about whether inclusion of some of them was crucial to project successes just reported or influenced outcomes adversely. We strongly suspect that decisions about program structure and participants were eased by our opportunity to use a half-dozen elementary teachers who in more affluent times had served as classroom consultants. With the encouragement of the Assistant Superintendent for Elementary Education, consultants had visited widely in the system--responding to teachers' requests for help with particular problems, conducting workshops, and instilling morale. Some contributed behind the scenes, and others served as program hosts or key participants. But their individual or collective impact on our project has not been measured systematically.

All we can say with confidence is that we found almost all program collaborators enjoyable, and some exhilarating to work with. But again, we were outsiders; the two staffs--the school system's and Michigan's--joined briefly without memories of earlier encounters or expectations about future relationships.

Prospects for continuation were kept firmly in mind when making decisions that affected direct expenses. Small format videotape technology was used, in part, because it was becoming more widespread. Portable television cameras with high quality and convenient tape editing equipment were coming on the market as production began, adding flexibility and economy previously unknown. We expected that audio-visual staff, already familiar with earlier generations of equipment for remote production, could easily master the newer opportunities, if given minimum budgetary support. More about that later.

Costs of promoting one-way and interactive programs were kept low. We employed a local project representative during the period of service delivery for assignments already described. Her contributions were essential to smooth functioning and to interest in programming among schools in both experimental treatments. All these ingredients of promotion can easily be duplicated.

Our greatest mechanical worries about continuation centered on program production, including decisions about content and scripting. Could we implant our client-centered approach? And could human skills be established sufficient to translate an agenda of information about classroom innovations into effective video and audio signals?

The teachers' production workshop.

The first stab at developing local resources for programming led to the show about Science Fairs. At the time we were disappointed by the product, but less by processes that produced it. The audio-visual staff in central administration pitched in to light sets, arrange audio, plan shots, man the camera and execute other technical chores. They were supervised by Michigan's director of television services, who had directed the primary in-service programs then being aired.

Earlier the Michigan team's producer had met with the schools' science education committee, solicited their advice about program emphases, and conferred with a principal and former science teacher about on-camera talent. The chief of audio-visual services recommended another participant.

In our haste we failed to bring all participants together with the director for a final session to plan content before shooting was scheduled. While this omission damaged program structure and content--fatally, we thought at the time--experience gained planning Science Fair gave confidence that local people could learn to produce in-service programming. We began to arrange a workshop.

Eighteen teachers and audio-visual staff took part under guidance from Michigan Television Center staff. Most of the teachers had participated in our major productions; a few others were added because they had come to our attention as interested and knowledgeable.

They began by selecting a content area they judged of interest to colleagues, based on their own contacts and discussions by our earlier needs group. It was spelling; a new package of curricular materials had just been purchased for the elementary schools, and the program could facilitate their use.

Next, the workshop identified potential participants and met with them to exchange ideas about content. As the stack of program ideas mounted, the workshop decided to produce three interrelated shows. One would be aimed at primary teachers, giving them ideas for reinforcing spelling skills. Another would be tailored for upper-grade teachers, four through six. A third program would be pertinent to all, showing games and other motivational techniques to engage students' enthusiasm for learning how to spell. Each would be 15-20 minutes long, including interactive segments.

Considering the values already apparent for question-and-answer viewing, the workshop decided to produce interactively. Programs would be watched by groups of teachers assembled in four of the experimental locations. Groups would briefly discuss the answer they preferred to each question, and this would be entered on terminal by a single individual. Observation at interactive buildings in the main experiment had disclosed that this plan would be consistent with viewing that was occurring naturally.

Repeated visits by the Michigan staff were used to raise questions about program goals and alternative ways to achieve them visually. We challenged workshop members to plan props and sets and to arrange program elements in continuity. We taught them scripting so that intense and frantic work during taping on location would successfully link the workshop's intentions with the finally edited product. Meetings with workshop members, augmented toward the end with on-camera participants, extended across two months.

Taping was planned in three school locations. With one exception, local equipment would be used, and all roles--technical and substantive--would be filled by teachers. We leased a Panasonic videocassette editor to enable immediate assembly of at least some program ingredients.

The workshop started production at 8 a.m. on a Monday. A small group of Michigan staff stood by to prompt workshop members when it seemed certain they might neglect a crucial step or make an irreparable mistake. The Michigan advisers used jokes, occasional praise and mock dismay to manage tension and maintain an effective work schedule. By mid-morning on Wednesday the group had taped all scenes in one program and parts of the remaining two. As thoroughly as possible, workshop members had rotated roles. Each had operated camera, looked after the recorder, served as director, arranged lights on set, and performed other functions, including keeping accurate shooting notes.

With Michigan staff looking over their shoulders, teachers took turns at the editor assembling all of their first program except interactive segments toward the end. We departed to catch a plane at 3:30 p.m. Wednesday, but not before the workshop had firmed its plans to videotape remaining program segments the following week and to send a small team to Ann Arbor to finish editing at the University's Television Center.

The excitement and sense of accomplishment workshop members shared are difficult to cast into words on paper. With the exception of audio-visual staff, only two had ever touched the controls of a television camera or tape deck before, and that had been years earlier in an education course at college. None had edited, using videocassette assembly technology. No one in the workshop had planned, scripted or directed production. But in a brief period, exchanging roles so that all had a chance to grasp the total process, they had developed three creditable productions. We were delighted with the resulting combination of pride and tempered confidence.

Arranging the means for continued system use.

The edited spelling programs remained "in the can" over summer months while we turned to securing long-term access by the Schools to interactive cable plant. In these negotiations, which had started with preliminary discussions more than a year earlier, we deferred to colleagues at Michigan State University. Their project with firefighters, much larger than ours, and their origination of the computer system and its software had yielded greater investment in equipment and priority in determining its disposal.

The two Universities and their Rockford partners--the Fire Department and Schools--were agreed on the desirability of keeping the computer and other system components on site. Line equipment on telephone poles and cable drops could not be removed economically in any event. The origination plant installed in Cablevision offices occupied a small amount of space not easily used for other purposes. Terminals and other ingredients operated with great technical fidelity. Personnel from the Fire Department had been trained to operate the system for that organization's applications following termination of Michigan State's experiment; we were confident people from the schools could reach similar proficiency.

We had learned enough about system maintenance--computer, amplifiers and terminals--to conclude that this burden could be met without costly contracts calling for monthly payments. Arrangements with service firms could be made on a per-call basis.

Michigan State developed a model contract between the Fire Department and Rockford Cablevision, shown in Appendix E, whose provisions would guide a similar agreement between the Schools and franchise operator. Details include careful listing of the depreciated value of headend plant. The two Universities promised to approach the National Science Foundation for authorization to convey this plant (approximately one third of whose value resulted from our experiment) to Rockford Cablevision; in return the firm would grant use at rates that would be "charged" against the plant's value--until the figure had been exhausted. At that point the parties would need to strike a new agreement.

While Michigan State, the Fire Department and Cablevision were launching an exchange of contractual proposals and counter-proposals, we began describing preliminary results to school administrators. We included a demonstration of programming and overview of findings to the School Board and meetings with the Superintendent and key policy aides. Informal meetings with the Assistant Superintendent for Elementary Instruction, audio-visual staff and groups of influential principals added to our progress reporting during the autumn following service delivery. We were able to say:

1) The interactive system works with great reliability.

2) The programming produced by Michigan appears to affect teachers--drawing substantial amounts of voluntary viewing and leading to adoption of ideas in the classroom.

3) Rockford teachers have been taught the rudiments of producing in-service cable programs themselves. Those among the Michigan staff who are professional broadcasters and television producers are impressed with teachers' accomplishments and confident they can acquire even greater skill with help we are delighted to make available.

4) Results we have assembled thus far suggest that interactive delivery promises significant benefits in what viewers learn from programs and how extensively they apply material to their own work.

   While only 14 sites are equipped for two-way, they can be used as assembly points for elementary teachers from all parts of the city.

5) Discussions between Michigan project staff and the Schools' audio-visual department disclose that a modest upgrading of production equipment is necessary to make use of the human resources now available. Principal items are a better camera and a cassette editing system--totalling $10-12,000.

6) If the Schools can make this financial commitment before the end of 1978, Michigan can lend further assistance to the use of cable for in-service while its grants from the National Science Foundation and the National Institute of Education are still in force. After December 31, our capacity to help disappears.

We were heard by all with expressions of gratitude for the experiment's contributions and affection growing out of the working relations we had established. But school administrators with budgetary responsibility raised an obvious question: What assurances had they for continued access to the interactive plant--after investing $10-12,000 in equipment and committing teachers' time for producing cabled in-service?

We could reply only that discussions about this were underway and describe the proposals that had been placed before management of Rockford Cablevision. School administrators found the outlines of Michigan State's model contract highly attractive.

Still reeling from budgetary shortages in the system, however, they felt unable to authorize investment of money and salaried time until a contract was signed. It should be added that their confidence in reaching a satisfactory agreement with the franchise operator had not been bolstered by recent correspondence from him on another matter. After three years of free use of an educational channel, Cablevision had written proposing the establishment of annual charges of $8000 per month, starting the next school year. This thunderbolt stopped us from making encouraging claims about the progress of discussions involving Michigan State and the Fire Department.

And there, sadly, the matter rests. As of this writing--September 1980-- an exhausting exchange of correspondence, discussions and contract drafts between Michigan State and Rockford Cablevision has failed to yield an agreement. One of the main sticking points is fundamental: How to calculate use rates that will eventually deplete the "reserve fund" keyed to equipment value. Cablevision reintroduces schemes based on annual charges that would end the Fire Department's use and access by the Schools within a year to 18 months. Both parties recognize the tough battle they would face seeking continuation of inexpensive use of interactive cable. Both want several years of low-cost use before allocating resources to incorporating interactive staff training as a substitute to more familiar, if less effective means.

The spelling programs, so enthusiastically produced, have yet to be seen by teachers. Because we needed a delayed measure of experimental effects, based on survey interviews in November, airing of the shows had to be put off until early 1979. By then it was clear a Cablevision contract would not be quickly forthcoming.

In conclusion, an important element to continued use should be added. At least one individual within the Schools must exert initiative and energy to promote cable, even if favorable contract conditions are achieved. This exertion requires risk-taking of a rather high order. While conventional in-service may yield thin results, it is familiar and institutionally sanctioned. The number of hours teachers can be asked to spend is written into union agreements.

Anyone who would upset these arrangements by imposing new technology had better possess self-confidence, adroitness in selling the new medium, and a command of ways to produce programs effectively for it. Failure carries penalties of embarrassment and loss of authority, at the least.

Who might take the chance? The Assistant Superintendent for Elementary Instruction, our experiment's most ardent champion, has recently been elected Superintendent of the Intermediate District of which Rockford Schools is one member. She is up and out. The chief of audio-visual services faces many competing obligations supplying instructional material over the educational channel, ordering films and in other ways, serving a large and hungry clientele. His time and energies are in short supply.

Several building principals could be inspired to assert demands for in-service on cable, but their individual power is limited. A coalition might be formed to lobby with central administration, but an inevitable rejoinder can already be heard: From whose budget do we take the money? Members of our teachers' production workshop--indeed, all who participated in programs--are back in their classrooms, dispersed. Many are feeling lucky to have jobs at all in these times of declining enrollment and continued crisis in funding for public schools.

In this vacuum the logic of cost benefit analysis is shadowy and indistinct. Nonetheless, we relate our experiences, supported by appropriate data, so that others might learn some of the achievements from interactive and regular cable and the trials one confronts in implementing a new medium.

Chapter 5

FINDINGS FOR POLICY DECISIONS: COST/BENEFIT ANALYSIS

The strong correlation between programs watched and innovativeness in the interactive condition (see p. 24, Chapter 3) encourages further evaluation of differences between the two experimental treatments. Some evidence is available that frequency of interactive viewing exerts a greater push toward new ideas than amount of exposure to conventionally cabled training. The finding invites us to gauge whether costs of two-way are balanced by benefits.

One cannot take refuge in neat formulas for this appraisal, there being no empirical threshhold demarking insufficient from sufficient differences. Subjective judgment can be assisted, however, by a brief review of main findings and assembly of key data into a single array.

Differences among treatments were observed, in the predicted direction, for amount of viewing, awareness of new teaching ideas, and Science Fair entries. Benefits were spread evenly across teachers--regardless of their age, teaching experience, grade level, level of college preparation and many other formal characteristics.* Innovations conveyed by telecommunication do not cluster among types of teachers, at least according to how one conveniently thinks of type.

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*In the field of educational research studies frequently focus on rather traditional demographic characteristics of teachers as predictors of job performance and productivity. We collected individual data on such independent variables (highest degree obtained, number of years of teaching, teacher age, and grade taught) and correlated these responses with our measure of job performance, classroom innovation. Regardless of treatment group, correlations between innovation and demographic characteristics fail to achieve statistical significance; i.e. level of education, years of experience, age and grade taught all fail to stratify the effects of the technology and the information acquired and used by teachers in their classrooms.

We pursued further individual level analysis using standard batteries of job descriptions for measuring teachers' feelings about both their ideal and present jobs. Again we were guided by traditional occupational research which suggested the the measures administered for ideal and present jobs would result in two factors, one extrinsic (e.g. the salary is good; the hours are good) and the other intrinsic (e.g. the work has value to society; I have a feeling of accomplishment after I finish a day's work) to be used as reliable predictors of job performance for various types of teachers.

In fact, application of a principal components factor analysis using Kaiser's Criterion as the cut-off and oblique rotation resulted in three factors--one extrinsic, one intrinsic, and one additional factor relating to support (e.g. I know exactly what is expected of me by my supervisor; I receive encouragement for initiative). We then constructed indexes of the raw individual level data based on dimensions identified by the factor analysis and entered the result variables into a regression analysis as predictors of number of ideas, our measure of job performance, by treatment group--control, one-way or interactive. We also correlated the indexes with measures of telecommunication behavior, such as viewing programs, requesting free materials, discussing ideas with others, and trying ideas. In all cases the indexes provided minimal insight with compared to the explanatory power of variables relating to interpersonal relationships in the work environment.

In addition, exposure to interactive fare was embedded in a richer collegial context than arose in one-way schools. Group viewing was planned, and teachers were more aware of each other's use of the system than was found for conventional cable.

Nonetheless, one hesitates to conclude that results are uniformly encouraging. We have observed the increased stratification among experimental buildings. Those that rank high on one set of innovative ideas are high on other kinds. Much of this stratification derives from social structures in buildings. Those with diverse norms and a high degree of peer interaction gain much more from cabled in-service than homogeneous workplaces, or staffs who do not talk with one another about teaching.

Whether one reads stratification as an evil to be avoided or as an inevitable result of social change depends on values as well as empirical evidence. Stratification should not be overlooked, however, as a consequence of the stimulus toward productivity field tested here.

That having been said, we should examine experimental effects in light of the 21 per cent greater cost of producing and delivering two-way material (see p. 28, Chapter 2). One method views outcomes in terms of proportional increments. Amount of our investment in stimulus intensity orders treatment groups from control, to one-way, to interactive. What increments of benefit do we find, moving from the low to high end of this narrow scale?

That logic cannot be applied completely to program viewing, since controls did none, and there are limitations to the analysis we will note when comparing control to one-way schools along other response dimensions. But the method has some utility for organizing a cost/benefit analysis.

We start with viewing. Twenty-four per cent more interactive than one-way teachers watched at least a single show, close to the margin of difference in operating costs. Each additional dollar brought a proportionate advantage in audience reach. This calculation fails, of course to include capitalization costs for establishing interactive capability for staff training.

Table 5-1 contains proportional increments--one-way vs. control, and interactive vs. one-way. In Part A, above the dashed line, three ways of examining the same outcome behavior are shown. Mean number of ideas is our most inclusive standard; proportion of teachers in each building reporting ideas in one of our programmed categories is more restrictive on conceptual grounds. Proportion of buildings scoring above the median in innovativeness represents a methodologically timid way to express the same outcome.

The indexes for new ideas appear in Table 5-1 in order of the size of benefits, looking from top to bottom in Part A. The reader can take his or her pick.

We think the middle ground safest, based on share of teachers who are applying ideas of the same kind that appear in programs. This measure should have greatest meaning to managers of in-service activities for organizations. They will want to judge contributions from telecommunication in terms of explicitly identified programming goals--most obviously the imparting of work information that is an intended component of videotape presentations. The middle variable in Table 5-1 stands as our closest analogue.

Whether or not a 51 per cent boost resulting from one-way cable justifies its expense cannot be resolved simply. Had we tried to convey the same in-service material, in a less striking way through familiar workshops, control schools might have looked better, narrowing the margin of improvement. Lack of a pure control comparison limits our appraisal.

TABLE 5-1

PROPORTIONAL INCREMENTS IN BENEFITS, COMPARING CONTROL TO ONE-WAY, AND ONE-WAY TO INTERACTIVE CONDITIONS

		One-way benefits over controls	Interactive benefits over one-way
PART A	Mean number of ideas	+28%	+15%
	Teachers reporting one of programmed ideas	+51%	+30%
	Buildings averaging more than one idea per teacher	+87%	+43%
PART B	Number of Science Fair projects	+86%	+92%

Interactive benefits over one-way are less equivocal, perhaps, on grounds of research design. The edge of 30 per cent falls in the same order of magnitude as heavier costs of production and distribution, 21 per cent.

A final benefit comparison, shown in Part B of Table 5-1, uses number of Science Fair entries. Advantages appear substantial for each delivery mode, although high variability within treatment groups suggests we view these margins with caution.

Our cost/benefit comparisons invite a variety of judgments about the usefulness of telecommunication. But an inherent limitation should be recognized; we have been rigidly quantitative. We have assumed that both dollars and number of ideas can be treated as ratio scales. This abandons placing a higher value on professional growth among some identified sub-group of teachers, or recognizing that teachers who gain a single new idea, after having had no thoughts about classroom innovations, may represent a more valuable prize than staff who grow from having one to having two or more ideas.

These shades of benefit analysis may appeal to others using new telecommunication technology.

Conclusion.

This experiment leads us to five judgments. The confidence placed in them by others who would use interactive cable depends on acceptable threshholds of statistical significance, comparability of institutional settings, similarities in goals for increasing productivity, availability of production skills and other issues we have already discussed.

One. An interactive cable system with high working reliability and signal quality can be developed for use by public agencies in a community. This seems less of an accomplishment since the advent of QUBE, Warner Communication's lavish entry into the Columbus, Ohio market.

Two. A Client-Centered Production System leads to programming that will attract substantial numbers of voluntary viewers among school teachers. In our case the public system had been demoralized by repeated bond failures. We cannot determine whether this stifled teachers' enthusiasm for work and for improving classroom performance, or enhanced project results.

Three. Depending on one's index of effects--concentrating on the acquisition of usable classroom ideas--conventional cable yields important benefits when compared to the customary type (and frequency) of in-service through staff meetings and institute days. The margin of additional benefits resulting from interactive delivery is at least as great as additional operating costs.

Close inspection of correlations between viewing and program outcomes suggest that interactive experience itself is responsible for better results found in our two-way condition. _Why_ users are so responsive to interactive delivery remains unclear, however. Our confidence in social comparison processes could not be tested adequately in the rough and tumble of field experimental conditions--nor could attentiveness to program segments or other behaviors that might isolate benefits.

One social comparison opportunity does seem to be enhanced by two-way delivery; it is exchange between co-viewers and, possibly, an alertness to program reactions among other teachers in the building.

Four. Public school teachers and administrative staff can be trained to assume central roles in television program production. The jury is still out on the effects of their efforts, however, since our workshop's programs about spelling have not been tested by delivery to viewers--for reasons described in Chapter 4, p. 7ff.

Five. Achievement of continued benefits from interactive cable is difficult where negotiations involve a cable franchise operator whose priorities naturally turn to cash flow and the development of local markets. In Rockford parties to these negotiations include two public agencies, two distant universities, and a federal funding source in Washington, D.C. Perhaps it's naive to expect success.

The results of our research highlight additional issues that users of television for work productivity will want to consider. Among them is a central if sometimes hidden question--the choice of a criterion for measuring success. The acquisition of ideas--drawn directly or peripherally from program content--may not suit other institutional needs. To stack the growth in new ideas against programming costs, or against level of innovation resulting from routine activities, may strike some as too mechanical.

Diffusion of new ideas through television elevates the importance of social structure in the workplace in mediating outcomes. We noted increased stratification in innovativeness among buildings exposed to television. In Appendix D we present additional evidence about subtle changes in staff relationships, in the innovative complementarity found between principals and teachers in their buildings.

Others using television may be willing to take these risks, or may conclude they are inevitable by-products, or think of ways to moderate their effects.

Interactive television, displayed in a natural rather than laboratory setting, attracts group viewing and becomes a socially visible behavior. Future applications might explore ways to capitalize on this through program components and interactive routines that invite collaborative responding.

We found no special merit in combining televised staff development with an ambitious array of supporting print materials.

More needs to be learned, of course, about how ideas we elicited from teachers affect the quality of classroom learning. Whether or not students learn more, or learn differently, was beyond the grasp of this single field experiment. One can take hope in the outcome of Science Fair with its dramatic increase in school projects. But the ultimate beneficiaries of telecommunication applied to education remain in shadow. Their growth and accomplishments are uncounted rewards in the cost/benefit ledger measuring improved "productivity in the workplace."

Appendix A

PROGRAM SYNOPSES

Videotape Synopses

The following texts summarize videotape programs to provide a record of experimental stimuli.

For two programs, Metrics 1 and 3, interactive segments are quoted verbatim. These examples illustrate the way questions segments were handled in remaining shows.

Metrics For You: Temperature and Length

Rose Chaon hosts the Metrics series, totaling three programs. She starts with general objectives of the series, introducing the metric kit that will be used in the first two shows and that viewers will be able to request. The first two programs involve teachers from Rockford schools as they learn metric concepts and measurement skills. Program 1 deals with temperature and length, and program 2 concerns volume and weight. (Program 3 will demonstrate classroom ideas in practical application by teachers with their pupils.)

Rose introduces participants for the first two installments: Maggie Kempel, Karen Marks, Julie Wills, and Jeanne Finnegan. In their first exercise, the teachers try to guess the temperature--in Centigrades--of water in containers placed before them. They dip their hands into the fluid, giving estimations, and make precise measurements using Centigrade thermometers.

At this juncture a question flashes on screen, accompanied by voice-over explanation: "Let's try an estimation problem ourselves. What is the normal body temperature in Celsius? Would you say it's about:

(a) 18 degrees (b) 37 degrees (c) 52 degrees or (d) 65 degrees?

The correct answer is (b): 37 degrees.

"It's fun and easy to become skilled at estimating temperature in Celsius. Keep a Celsius thermometer outside your house and get in the habit of noting temperatures on Summer, Fall, Winter, and Spring days. That will give you a feel, literally, for the Celsius system."

Rose Chaon reappears to introduce basic concepts of linear measurement. She explains the meter and some history of linear units. She reviews the main linear metric divisions, as identified by the Greek prefixes "deka" (10), "hecto" (100), and "kilo" (1000), and the Latin prefixes "deci" (.10). "centi" (.01), and "milli" (.001). Examples follow for each type of metric expression.

The voice-over announcer introduces a new question segment: "Next we'll be asking a number of questions to help you practice your understanding of metric concepts. Don't be discouraged if questions seem hard to answer. No one gets right answers the first time. O.K., let's start. Use the terminal to answer.

"Rosie emphasized there are two important aspects to learning the metric system. First, one must understand that all measurement--length, volume, and mass--is related to the basic unit: the meter. Second, each unit of measurement shares a standard system of prefixes, which are based on multiples of ten. Let's try a few examples with these prefixes, to get a feel for it.

"The prefix which stands for 10 units in the metric system is:

(a) deci (b) centi or (c) deka?

The correct answer is (c): deka. Deka means ten units of a measure. This should not be confused with deci, which means one tenth of a unit.

"Let's try one more example with these prefixes. What is the prefix associated with one one-thousandth in the metric system? Is it:

(a) centi (b) kilo or (c) milli?

The correct answer is (c): milli. Milli means one one-thousandth of a metric unit. Centi means one one-hundredth. Kilo is one thousand units, as in kilometer or kilogram.

"The metric kit contains a place value chart to help you master the prefixes. Review the chart and practice using the terms; it's the only way to learn how to use the prefixes which apply to all metric units: the meter, the liter, and the gram. We'll show you how to get the kit in a minute.

"Rosie stressed how important it is for all of us to try estimating, so that we become more comfortable with the metric system. Here are a few problems to see how we do. Let's try to guess the dimensions of a regular sheet of typewriter paper. We can measure this in units as small as the milli-meter, but it's more convenient to measure in terms of centimeters. Would you say that a regular piece of paper is:

(a) 5 x 10 cm. (b) 21 x 28 cm. or (c) 40 x 50 cm.?

The correct answer is (b): 21 cm. x 28 cm. Skills in estimating improve with practice.

"Let's try another example. What is the height of most doorknobs? Would you say doorknobs are generally:

(a) 1 meter from the floor (b) 2 meters from the floor or
(c) 3 meters from the floor

The correct answer is (a): one meter from the floor. The meter is the fundamental unit in the metric system. A meter is somewhat longer than arm's length. As another example, a comfortable height for an ironing board is about a meter.

"And finally, let's try estimating the distance across the United States. About how many kilometers is it from Los Angeles to New York?

(a) 1000 kms. (b) 3000 kms. (c) 5000 kms. or (d) 7000 kms.?

The correct answer is (c): about 5000 kilometers. When we're measuring a long distance, such as across the United States or between cities, we use kilometers, a measurement unit which means one thousand meters. When we measure smaller things, like pieces of paper, we use the centimeter, which means one one-hundredth of a meter.

"Here's a question asking for your opinion. How soon do you think the metric system will come into general use in the United States? Will it be:

(a) in the next year (b) sometime in the next 2 or 3 years
(c) sometime in the next 4 to 8 years or (d) is metrics more than 8 years away?

Here's how teachers at different schools feel. The percentages are those who think metrics will come within the next 3 years. If a school is missing, it means that fewer than four of its teachers have watched this program. Percentages for these schools will appear in later program showings as more teachers watch and respond to the question.

"The metric system is creeping up on us faster than many people think. We'll have to start teaching it to kids now, so that they--and we--will be ready to use metric units in a few years. Now, back to Rosie."

Rose presents the metric kit and its contents in detail. Finally, the voice-over announcer explains how viewers can obtain their own: "If you want the free kit which contains metric items, use button A. Your name will be listed in a minute on the screen. This will alert us to send you the kit. You can decide later if you would like the kit. Please press either A or B and then the 'Send' button.

"Here's a listing of teachers in each school who have asked for the metric kit to date."

Metrics For You: Volume and Weight

The same teachers involved in the Metrics 1 program are presented at the beginning. They work with the concept of "liter" and apply to it the prefixes used for length measurements (i.e., deka, hecto, kilo, and deci, centi, milli). Certain materials from the kit are used in practical applications.

Different measurement exercises are performed, related to the notions of volume, weight, and mass, some of them including guesswork estimations on the part of the teachers. Again materials from the metric kit are used and examples are given to devise classroom exercises with them.

The voice-over announcer introduces questions. These deal with the relationship between the different measurements in the metric system, and viewers are asked to make estimates in terms of liters, centimeters, and kilograms. The use of prefixes is also tested in this fashion. Then an opinion question is asked: "How do you feel about your understanding of metric measurement?" The choice of answers is (a) getting better (b) staying the same and (c) even more confused than before. After a pause percentages are shown for how viewers answered this question to date (interactive version).

Finally, instructions are given to the viewer on how to obtain the metric kit.

Classroom Ideas For Teaching Measurement and Metrics

Rose Chaon presents the objectives of this program: to provide the teachers with examples and strategies used by other teachers in the Rockford School System to instruct children on basics of metric measurement.

The classrooms where the exercises are to be conducted are those of Susan Anderson (3rd grade) and Clare Almquist (1st grade) at Haight School, and David Hawkinson (5th grade) and Mary Skerkoske (6th grade) at Garrison School.

Clare Almquist's students measure the length of a snake drawn on the blackboard, using several materials from the measurement box. Some children created their own tools, like a giant footprint, and after the different measurements have been made and compared the teacher emphasizes the need for a uniform measure.

Rose and Clare talk about the exercise and benefits that can be derived from it.

Next, the voice-over announcer introduces a question: "Clare's first grade class was measuring familiar objects in the room using different units: the big foot, tape of hand prints, even straws and string. What was Clare's purpose?

(a) To familiarize students with the metric scale?

(b) To provide students with an interesting classroom activity? or

(c) To help discover the need for a uniform measurement scale?

The answer is (c): Clare wanted students to discover the need for a uniform scale of measurement so different objects can be compared.

"At the start of the school year, how many of the kids in your classroom understand the need for a common system of measurement units? Would you say:

(a) almost all your students start the year understanding this, or

(b) that too few students understand the need for common measuring units when they start the year?

In a moment you will see a chart showing how many teachers at each grade level feel that too few of their students start the year understanding the need for a common system of measurement. Each row shows teachers at different grade levels; the more X's in the row, the more teachers who feel that many of their students lack understanding of common measurement. This gives some idea of where there is need to teach basic understanding of accurate and comparable measurement.

"Which of these is the best answer? When Clare's students work with the measurement box,

(a) they practice measuring familiar objects,

(b) they find worksheets that show both pictures of the objects to measure and names of the objects,

(c) they check their measurements against the correct answers themselves, or

(d) all of these things?

The answer is (d): all of these things. Clare's measurement box provides a total learning activity in which groups of kids take care of themselves while she's busy with other students. Now, back to Rose."

She introduces metric games being played in Susan Anderson's class. "Metric Olympics" comes first: it consists of indoor activities, like throwing a cotton ball and then taking measures with a metric tape to compare the different distances reached by the participants. Other games involve liquid measurement (pouring water in containers of different shapes and sizes) and height and weight measurements.

Rose and Susan discuss the games, how to get or make the materials and conduct this kind of activity. Susan explains how to deal with certain specific situations, like the organization of the classroom work (e.g., around "interest centers") and the invention of new games.

The second question segment is introduced at this juncture: "Sue and Rosie talked about worksheets and activities for teaching metrics. A team of Rockford teachers has prepared a booklet of these ideas. Later in the program we'll tell you how to get your free copy. Sue's class spends a lot of time in group activities learning metrics and measurement. Which of these points did she make about the use of group activities?

(a) Activities are good for practicing what has been taught by conventional methods, or

(b) Teachers should use group activities in order to keep kids interested?

Sue emphasized point (a): that games and group activities help reinforce ideas that have already been introduced to students.

"Sue uses interest centers in which students keep folders containing records of their work. In your opinion, what is the most important advantage of interest centers like this?

(a) With different interest stations, several group activities can be run at the same time.

(b) Interest centers require kids to practice actively what they've learned,

(c) Worksheet folders allow the teacher to check students' progress at the teacher's convenience, or

(d) some other advantage is most important?

Here are the answers that teachers have picked to date. If you like to use interest centers, you may feel you gain all these benefits and more that we haven't listed. Now, back to Rosie."

In the following sequence, Dave Hawkinson works with a group of 5th and 6th-grade children. He has them fold sheets of paper and measure lengths and widths at consecutive foldings. They also make paper tape meters using decimeter rods. Dave stresses repeatedly the importance of being able to make estimations of the outcome before final measurement takes place. The children are asked to estimate the length of different parts of their body or clothing (fingers, palm, arm, shoes, etc.).

With the same children, Mary Skerkoske conducts exercises in mass and weight measurements, working with a balance scale made in the classroom using wire hangers, string and paper cups. As a unit of measurement they use two paper clips, which equal one gram. As before they first estimate and then weigh different objects.

Back with Dave, the students learn the relationship between liters and cubic centimeters. The notion of volume is presented by dropping "centicubes" (plastic cubic centimeters) or other objects into pitchers marked with metric measures and filled with water. The children estimate the changes in volume and then measure them.

Rose interviews both teachers--Mary and Dave. They explain how they carry out their teaching and why, what strategies and materials they use, and what pace they recommend in teaching metrics.

Then comes the third questions segment: "Dave and Mary asked students to estimate lengths, volumes, and mass before actually measuring in metric units. In your opinion, which of the following is the single, most important reason for estimating before measuring?

(a) Doing both increases students' accuracy in making estimates,

(b) Doing both helps kids gain a mental picture of metric units,

(c) Doing both provides more practice in using metric terms, or

(d) There's an even better reason not listed here?

Here's how teachers have responded to this question to date. Actually, combining estimation with measurement helps accomplish all the goals listed. Perhaps you can think of additional benefits.

"Here's a question about all of the things you've seen in this metrics program so far. Overall, what is the single idea the program has emphasized most to teachers? Pick a single answer that seems best to you. Then we'll see how other teachers feel, who watched.

(a) Most tools for measurement and metric education can be easily and cheaply made,

(b) Manipulative activities by students using measurement tools capture their interest and help reinforce what they've learned,

(c) Teachers should ignore their own uncertainties about metrics, start teaching metrics and learn along with the students, or

(d) The program emphasized a different idea than these.

Here's the percentage of teachers so far who have picked each answer. Whatever you feel the program emphasized most, we hope you will find it useful. You can view it again and as often as you want. Just consult the program guide taped to the TV set.

"Here's Rose to show you some metric teaching aids. After that, we'll show you how to get the free booklet of metric teaching activities."

Rose presents the various commercial materials used in all three programs: charts, games, scales, gadgets, etc. In addition, she mentions and briefly displays the content of two booklets prepared by teachers in Rockford to teach metrics.

The voice-over announcer tells viewers how to obtain booklets.

Classroom Ideas Using Creative Dramatics

The voice-over announcer presents the purposes and useful aspects involved in performing games, role-playing, self-expression, story dramatization, and acting exercises, all of which will be illustrated in the program.

Peg Weber serves as host. She informs viewers that the first example of the use of Creative Dramatics will be shown in Bill Lundberg's kindergarten class at White School. In his class children have to imagine being in several specific situations, and must make the corresponding facial expressions. Then Bill reads a story about a red hen and her chicks who encounter other animals (a duck, a mouse, and a pig) on a farm. Afterwards, he asks questions about the plot, and directs the children in a re-enactment of the story.

In the following segment Peg and Bill talk about this exercise. Bill discusses other games suitable for children up to the 4th grade. He points out how the teacher can handle various situations and stresses the importance of free expression.

The voice-over announcer summarizes some of the benefits for enacting feelings, and introduces the free book "Development through Drama." A question is asked about the objectives of Bill Lundberg's exercises. In the interactive version percentages are shown for how other viewers answered previously.

Peg makes the transition to the next sections, at Wight School, with Lana Engen (warm-up, movement activities) and Beck Schroer (story-telling).

In Lana Engen's class the students describe imaginary objects that she draws from a bucket. They all sit on the floor, forming a circle, and one by one they take guesses at describing and defining the imaginary object.

A question is asked to the viewers, concerning the main objectives and benefits of the previous game. Percentages are given for how other teachers have answered.

Back to Lana, now conducting an exercise in role-playing. She beats on a drum and suddenly says: "Freeze!" The children, who are moving about the classroom, must stop their action. She asks them to describe what they were doing and explain their present posture. This increases their vocabulary and creates an awareness for different social roles.

The voice-over announcer presents another question, this time about the viewer's inclination to use the technique just seen. In interactive fashion the answers of previous viewers are shown, by grade level, indicating whether teachers would or would not use the role-playing game with their students.

Next, Becky Schroer conducts an exercise in which children read a story about a bear and a mouse. Some of them play the main roles, others mime parts of the action, and still others help make the corresponding sounds (bells, footsteps, etc.).

Peg talks with Lana and Becky: they describe what was done, the purposes they pursued, and how they came to develop these exercises and games. Becky and Lana suggest strategies to control role-playing behavior in the classroom, and tell of past experiences concerning the use of creative dramatics. They emphasize the teacher's self-confidence as an important requirement for using dramatic games.

A last question is asked of viewers: Whether they consider "having fun" as a good enough reason to use child drama in the classroom. The proportion of teachers in each school who answer yes is used as feedback.

Peg presents the book "Development through Drama," by Brian Way, which contains examples of creative dramatics and explains purposes behind them. She then offers a summary of the main objectives illustrated in this program.

The voice-over announcer informs the viewers how to obtain the book, thus bringing the show to its conclusion.

Classroom Ideas For Creative Writing

Betsy Homewood, the program's host, presents writing as an important classroom activity: It offers the children opportunities and positive reinforcement for expressing themselves. She also stresses that spelling should not count so much, at least in the beginning.

Betsy shows available materials about creative writing and suggests ways to motivate the children to write: Ideas for topics ("Suppose you're one-inch tall; suppose you're a lamp" or up-dating fairy tales) and how to develop them. She gives an example in her own class, as she conducts an exercise in which wishes are expressed in short poems. The children discuss the poems, write their own, and read them aloud to the class.

The voice-over announcer asks a question about the number of teachers in viewers' buildings who have writing projects throughout the year. The interactive version includes the percentages of viewers, for each school, who said that many teachers in their school had writing projects. The announcer then introduces the free materials that will be offered at the end of the program.

Next, Ethel Corirossi, of White Swan School, talks about interest centers. She presents creative ideas, like opening sentences, or pictures, with which students can work.

The voice-over announcer summarizes the main differences between Betsy's and Ethel's approaches: warm-ups vs. interest center, and group activity vs. individual work. The viewer is asked about which technique he or she prefers. Interactive segments show how teachers answered up to the viewing date. Another question asks whether early editing of the students' writing is a better approach than avoiding writing evaluation altogether. The percentage of teachers, at each grade level, who would rather avoid such an evaluation is provided in the interactive version.

The next scene is with Frank Anderson, a sixth-grade teacher in Johnson School. Frank talks to Betsy about his writing program and presents assignments and strategies to motivate students. Then he conducts a class exercise: after reading mystery book titles, he asks the children what kind of stories they might be about. He also inquires about the different writing genres they know, and stresses the use of key words in the titles presented. The children offer titles of their own, also for mystery stories, and then do short write-ups of those stories. Another exercise consists of asking the child to imagine he is an inanimate object and to write a few paragraphs about it.

Frank and Betsy discuss some of the benefits derived from ideas that have been presented. Frank suggests that the teacher can control a story over a certain period of time and thus evaluate the student's progress.

The voice-over announcer provides arguments why children ought to share their writing with others, and also arguments why they ought not. The viewer is asked to express his or her opinion on the subject. Another question deals with the amount of time the viewers think they might have to work personally with their students around writing tasks as a classroom activity. For both questions the interactive version includes the percentage of answers that other teachers have given to that date.

Finally, Betsy thanks the participants and the viewers. She then presents some free materials--booklets that contain writing ideas intended to help teachers--and gives instructions on how to obtain them.

Classroom Ideas For Developing the Students' Listening Skills

Betsy Slabaugh hosts this program, which involves teachers and students from McIntosh School.

Before starting, viewers are asked a few questions about their classroom experiences with children's listening abilities. Querries deal with different student behaviors as they result from listening vs. not listening. Viewers in interactive buildings are shown how other teachers, at each grade level, answered these questions. The voice-over announcer also mentions books that will be offered later on.

Betsy presents the first segment, in which Mary Keehnen's third-grade students play two games. The first consists of the teacher giving verbal instructions about geometrical shapes which the children must draw on sheets of paper; if the instructions are followed correctly the final outcome is the drawing of a house. The second game is the familiar "I went to the store and bought..." in which children must recall and repeat all the words on the list, and then add their own contribution. This game helps increase attention, word recall and vocabulary in addition to developing listening skills.

Mary is interviewed by Betsy about these and other strategies that emphasize listening, such as music or mental arithmetic exercises. They also discuss the use of different materials.

Next, Roberta Stiles (fifth grade) and Wanda Hill (sixth grade) conduct classroom exercises in several areas of study--recall of words, review of numbers in mathematics, or language arts--always stressing the part played by listening skills. Roberta, for example, asks questions orally, and her students must give suitable answers and explain them; they must also recall other children's questions and answers. Wanda has her class listen to each one's oral report on a given theme; later, the students must critique each other's work, pointing to both positive and negative aspects. This exercise helps children learn to listen to others and to respect them.

The voice-over announcer introduces a new questions segment. The first hour concerns arguments that have been advanced about television and its relation to some children's poor listening skills. The viewer is invited to give his or her opinion on the subject. The interactive version shows how other teachers have answered. Another question asks whether the need is felt for more in-service training on this topic. Interactive programs display the proportion of teachers at each grade level who think listening skills is an important enough topic to be covered further by in-service training.

Betsy presents books offered to the viewers. Among others, the titles include "Values Clarification" and "Perceptual Communication Skills." There is also a packet of prepared materials, put together by teachers in Rockford, that contain ideas for developing listening skills.

The voice-over announcer informs the viewers how to obtain these books and materials. In interactive buildings a list appears on the screen, as usual, of all the teachers who have requested materials up to then.

Classroom Ideas For Language Experience

The voice-over announcer explains that language experience is an important topic, closely related to other areas such as reading, writing, and speaking.

Clare Almquist is host. She introduces the program, noting that language experience concerns mainly a child-centered approach, as it emphasizes the language used by the child, and that the exercises to be presented are suitable for multi-age grouping.

The first segment shows Delores Kuberka with five children from her kindergarten class at Beyer School. The children answer orally to her questions about what to do to get ready when one is planning a trip to a farm. The voice-over announcer stresses the fact that planning and storytelling are activities that help increase the child's vocabulary. The teacher must motivate the class and make students use their own words and expressions.

Clare and Delores discuss the use of language experience in art work, in describing class activities (like field trips), and in inventing stories from drawings or short sentences.

Next, Clare interviews Howard Labrant, a second-grade teacher at Carlson School. Howard explains his use of language experience to get the students involved and to integrate the entire language arts process: speaking, reading, writing, spelling, and critical thinking. He has children write stories, for example, first as a group, then in smaller subgroups, and finally by individuals. The children keep their own special words in boxes labelled with their name, or on cards attached to a ring, and with those words they gradually create sentences and stories which they record in notebooks or on posters on the wall of the classroom. Howard shows some components and results of this exercise, at different stages of its development.

The next segment takes place in Betsy Homewood's sixth-grade class at Nelson School. Some of her students read compositions they wrote about what they did the previous weekend--a baseball game, a picnic, catching rabbits, and so on. Betsy uses the contexts of those stories to create more awareness of the students' own language skills (e.g., compound words used), or to teach new ones.

Clare and Betsy talk about the advantages of language experience, and how the personalized approach is particularly useful for children with reading problems. Working with their own familiar language makes tasks easier and thus enhances learning.

The voice-over announcer offers a short summary, emphasizing the pros and cons of language experience. He then asks the viewers a question, about the approach that works best for them--whether it's individualized teaching, a more structured method, or a combination of both. In interactive mode the answers picked previously by other teachers are displayed on the screen, in percentages. The announcer introduces the free reading materials on language experience that will be described later and follows with another series of questions.

He asks whether viewers consider language experience easily adaptable to teaching children of varying language abilities, and whether it is best for motivating children and increasing their confidence. Interactive versions show the proportion of teachers at each grade level giving affirmative answers. Viewers are then asked for their opinion about the proportion of teachers who might know how to shift control between themselves and students well enough to use language experience. Viewers in interactive buildings can see how others answered previously. A final question deals with the number of teachers in the viewer's school that use language experience as a major part of their teaching: whether most, some, or only a few of them do.

Again, interactive versions display the pattern of previous answers, this time showing the proportion of teachers in each school who claims that "most" of their colleagues use language experience as a major part of their teaching.

Finally, Clare presents the books and materials on language experience and informs the viewers how they can obtain them.

How to Do a Science Fair Project

The host for this program is Bob Facklam. He interviews Dick Mortweet, a teacher at Walker School, on the subject of how to involve students. Dick outlines his strategy, which consists of five steps: (1) motivate, create an interest for having an exhibit in the Science Fair; (2) help students decide on a topic, using sources like books, museums or hobbies; (3) gather information; (4) construct the project, making its presentation clear, safe and durable; and (5) arrange the display with the various collections, experiments and models.

Bob offers a brief summary and then talks to Suzanne Kee, from Wight School. She explains how to organize the class for a Science Fair and stresses that teachers need to be motivated as well as students. Some of her suggestions include having the children observe the life around them, teaching them to be creative, and also organizing Science Fairs within schools so that the best projects can participate in the city-wide competition.

Bob presents a packet of free materials containing guidelines and suggestions for Science Fair projects. A number of questions follow, introduced by the voice-over announcer, concerning interest that viewers might find among their students for Science Fair projects, specifically for developing collections, constructing models or doing experiments. Another question inquires about the proportion of children in the classroom who come from families that would--in the teachers' opinion--support such projects. For all of these questions the interactive version shows how other viewers responded previously.

A final question asks viewers for the number of their colleagues who will have some students working on Science Fair projects. This time the interactive mode displays the answers of other teachers by school (as customary, interactive schools must have at least four teachers who watched the program and responded to the questions before they can be listed on screen). The announcer explains how viewers can obtain the science kit presented earlier.

Spelling

The Spelling series, produced by the Rockford Video Workshop, comprises three programs: (1) Primary spelling; (2) Intermediate spelling; and (3) Spelling games. They all follow the outline of previous shows, i.e., they involve Rockford teachers in classroom activities, applying new and creative methods of teaching vowels, sound combinations, handwriting, prefixes and roots, and carrying out various spelling exercises. The programs alternate between actual performance of exercises by the students, whose reactions the viewers can witness, discussions led by the program's host with the teachers who have demonstrated their ideas, and summaries and questions related to the program's content presented by the voice-over announcer.

The first two Spelling programs open with an introduction by Blanche Martin, assistant superintendent for elementary education. She explains the objectives of the spelling unit and the criteria behind the selection of the Webster-McGraw-Hill spelling series by the Educational Development Committee and the Board of Education. These first two programs offer also free packets of materials put together by Rockford teachers. The third program shows teachers in their classrooms conducting different games that turn spelling lessons into easy and "fun" activities for the students.

Appendix B

QUESTIONNAIRE

This list of questions includes major items from questionnaires in one or more of the waves of interviews.

Question Description	Wave 1	Wave 2
All of us like to feel that others notice when we do a good job. There are different people who may give encouragement and recognition to a teacher who is doing a good job. Would you tell me whose opinions are important to you, I mean opinions about how good a job you're doing. (Unaided) a) Central Administration b) Area Supervisor c) Principal d) Other Teachers e) Students f) Parents g) Spouse/Family h) Other _______________ (specify) Anyone else?	X	X
(For each person or group mentioned, ask:) You've mentioned that ________________'s opinion is important to you. How often do they (does that person) recognize what a good job you are doing? Would you say that they (that person) notice(s) frequently, sometimes, or hardly ever?	X	X
(Follow-up questions involved rank ordering of the entire list of responses in terms of the importance of their opinions to the individual teacher, as well as frequency estimates of how often each tells the teacher what kind of job he or she is doing.)	X	X

Wave		
1	2	3
X	X	

Question Description

I am going to hand you a different list. On the list are different kinds of opportunities which a job might afford. If you were to seek your ideal job, teaching or otherwise, how important would each of the following be to you? For each, please check if it matters very much to you, matters very little to you, or somewhere in between.

If you were to seek your ideal job, teaching or otherwise, how important would each of the following be to you? For each, please check how much it matters to you. (Teachers were given an identical list and told to check choices which described their present job, ranging from describes poorly to describes well.)

IDEAL JOB

	matters very little				matters very much	not sure
the job security is good	___	___	___	___	___	___
the work has value to society	___	___	___	___	___	___
I have a feeling of accomplishment after I finish a day's work	___	___	___	___	___	___
I am given complete instructions as to how to do my work	___	___	___	___	___	___
the work is interesting	___	___	___	___	___	___
I receive encouragement for initiative	___	___	___	___	___	___
the salary is good	___	___	___	___	___	___
the chance for career promotion and advancement is good	___	___	___	___	___	___
I can do my work at my own pace without deadlines	___	___	___	___	___	___
I know exactly what is expected of me by my supervisor	___	___	___	___	___	___
the hours are good	___	___	___	___	___	___
I have lots of opportunities to make friends	___	___	___	___	___	___
the work has a lot of social status	___	___	___	___	___	___
I receive enough help and information to get the job done	___	___	___	___	___	___
I am given freedom to decide how to do my own work	___	___	___	___	___	___
I am given the chance to do the things I do the best	___	___	___	___	___	___

Question Description	Wave 1	 2
If you had a chance to start your working life over again, would you choose a career in teaching or something else?	X	X
Taking into consideration all things about your teaching job, how satisfied or dissatisfied would you say you are with it? Would you say you are very satisfied, somewhat satisfied, somewhat dissatisfied, or very dissatisfied?	X	X
Thinking down the road a bit, over the next five years or so, do you think that you will still be in teaching at the elementary level?	X	X
Would you say that you will definitely (not) be teaching or probably (not) be teaching?	X	X
(If not) What do you think you will be doing? Return to school to further education Drop out to have children Retire Be in an administrative position Teach at another level Leave teaching altogether Other ___________ (specify) D.K.	X	X
Are there any ideas or methods you've read, seen or heard about during this semester for different ways elementary teachers might do their work?	X	X
Are there any ideas or methods you've read, seen or heard about during the past/present school year for different ways elementary teachers might do their work?		
What are some of these ideas and methods? I'd like to write down each one. Any others?	X	X
Which of these ideas or methods are the two most interesting to you?	X	X
For the first idea mentioned the following series of questions was asked: Where have you read or seen anything having to do with (1st IDEA) __________? Anything else? Books Magazines Newspapers TV Film Conferences/meetings Educational journal Newsletter Principal Teacher Student Friend outside of school or Family Member Other D.K.	X	X
Have you discussed (1st IDEA) __________ with any people?	X	X
Who have you discussed (1st IDEA) __________ with? Anyone else? Principal Teacher Friend outside of school Family members Students Other D.K.	X	X

Question Description	Wave		
	1	2	3
Does (1st IDEA) __________ have any advantages or good points as far as you know?	X	X	
(Repeat for disadvantages)	X	X	
(If yes) Name one of the advantages. Any other? Another? Another?			
Have you tried (1st IDEA) __________ or not?	X	X	X
(If yes) Is (1st IDEA) __________ working well for you or not?	X	X	X
(If no) Are you thinking of trying (1st IDEA) __________ or not?	X	X	X
(Repeat sequence of questions about the first idea for the second idea mentioned.)	X	X	X
Are there any in-service training activities conducted at your school?	X	X	X
(IF YES ASK:)			
How often are these activities held? Would you say they are held almost every month or less often than that?	X	X	X
Let's talk about how you feel about these in-service training activities. Would you say that the ideas that are presented are always useful to you in your teaching, sometimes useful, or rarely useful?	X	X	X
How often do you say anything during the activities about the ideas being presented? Does this happen almost always, sometimes, or rarely?	X	X	X
Are there any topics you would like to see covered by in-service sessions for you, or have most topics been covered pretty well already?	X		
(If want more topics) What topics would you like to see covered? (RECORD RESPONSES BELOW):	X		
(If NO or DON'T KNOW, to initial in-service question) Are there any topics you would like to see covered by in-service sessions?	X		
(IF YES) What topics would you like to see covered? (RECORD RESPONSES BELOW):	X		
Are the in-service training activities held for all teachers regardless of content area, around your specific content area or both?		X	
Let's try and think about the content formally presented in these in-service activities as distinct from your informal discussions with fellow teachers. How valuable would you say the formal content is. Would you say it is almost always useful, sometimes useful, or rarely useful?		X	X
Now, in thinking about your informal discussions with other teachers, would you say the content of these informal discussions is almost always useful, sometimes useful, or rarely useful?		X	X

Question Description	Wave 1	Wave 2
Let's think about some of the in-service programs on television which have been shown during this school year. Did you watch any of the programs, I mean any of the programs since September, 1977?		X
Could you tell me which programs you remember viewing? (CIRCLE PROGRAMS IDENTIFIED. DO NOT READ LIST.) Any others? 1 Metrics — A program for teachers about linear and temperature in metrics 2 Metrics — A program for teachers about weight and volume in metrics 3 Metrics — Classroom ideas for teaching measurement skills and metrics 4 Science Fair — How to do a science fair project 5 Language Arts — Use of creative dramatics ideas in the classroom 6 Language Arts — Getting creative writing projects started 7 Language Arts — Teaching listening skills 8 Language Arts — Using the language experience approach 9 Spelling		X
I am going to hand you a list of programs. Perhaps this list will help you to recall programs you have seen but weren't sure of. (HAND CARD. CIRCLE ALL PROGRAMS MENTIONED.) 1 Metrics - linear & temperature 2 Metrics - weight & volume 3 Metrics - measurement skills & metrics 4 Science Fair 5 Language Arts - creative dramatics 6 Language Arts - creative writing 7 Language Arts - listening skills 8 Language Arts - lang. experience 9 Spelling		X
Thinking about the program(s) in general, how useful would you say they were? I mean, how useful was the content presented in the programs? Was it very useful, somewhat useful, or not too useful?		X
Thinking of the things that were useful, what, in particular, do you think was useful to teachers? (LIST ALL RESPONSES)		X
Looking at this list (HAND PROGRAM LIST), which programs would you say were most useful? (CIRCLE ALL RESPONSES.)		X
Which programs would you say were least useful?		X
(IF WATCHED) What are the reasons you watched the programs? Any others?		
(IF DIDN'T WATCH) What are the reasons you did not watch the programs? Any others?		
How would you compare the television programs to other kinds of in-service training you have had? Would you say the television programs were more useful than other in-service, about the same, or less useful?		
Did anyone encourage you to watch the programs?		
(IF ENCOURAGED) Who encouraged you to watch? Was it your principal, other teachers in your school, someone else, or a combination of these? If combination: Who encouraged you? (Circle responses that apply).		

Question Description	Wave		
	1	2	3
Now I would like to ask you a series of questions about the program(s) you watched. Of course, you might not have had a strict routine, and things probably changed over the course of the year, but try to answer the questions thinking about the programs in general.			
In general, how did you view the program(s)? Did you usually watch the program(s) alone or with some other people or both?		X	X
(IF WITH OTHERS) Was there usually a planned staff meeting when everyone got together to watch the programs, or did you personally arrange to watch with others, or did the group get together in some other way?		X	X
(IF BOTH) Think about all the programs; would you say you most often watched alone, watched alone and watched with others about equally, or most often watched with others?		X	X
Did you ever talk with other people about the things presented in the programs?		X	
(IF YES) Who did you talk to about the programs? (CIRCLE ALL WHICH APPLY). Principal Teachers Friends Students Family Other ____________________ (specify)		X	
Would you say that you talked with the same people all the time, or would you say that you talked to different people, depending on the program?		X	
Looking at this card again (HAND CARD), can you tell me which programs you talked about? (CIRCLE ALL PROGRAMS MENTIONED.)		X	
Did you watch any of the programs more than once?		X	
Looking at the card again, which of the program(s) do you remember watching more than once? (CIRCLE ALL PROGRAMS MENTIONED.)		X	
And which of the programs do you remember watching more than twice? (CIRCLE ALL PROGRAMS MENTIONED.)		X	
Did you ever try any of the classroom ideas or activities presented in the programs?		X	
(IF YES) Which ideas did you try? Let me get each idea separately.		X	
Anything else?			
Let's think about other teachers in your school. Would you say that, in general, teachers watched most of the programs, some of the programs, a few of the programs, or none of the programs?		X	

Question Description	Wave	
	1	2
As you may know, free materials were offered in conjunction with the programs. Did you obtain any of these materials?		X
How useful were the free materials? In general were they very useful, somewhat useful, not very useful?		X
Do you know any other teachers who obtained these materials?		X
In general, would you say that other teachers found these materials very useful, somewhat useful, or not very useful?		X
Were there any questions asked for viewers to think about, or weren't specific questions for viewers included in the programs you watched?		X
(IF YES) Do you think the questions caused you to pay attention to the programs more than you would have if questions like that weren't there, or didn't the questions make any difference in amount of viewing attention?		X
Do you think you got more out of the programs that you could use in teaching because of the questions, or didn't the questions make any difference?		X
(For INTERACTIVE RESPONDENTS) In your opinion, was it helpful to be able to respond to questions, or wasn't that a helpful feature?		X
In your opinion, was it helpful to see how other teachers in other schools, or in different grades, had answered some of the questions, or wasn't that a helpful feature?		X
Did you ever personally use the terminal to answer questions, or did others always use the terminal for answering?		X
What did you think about these questions, generally? Were they useful to you, or not very useful?		X
(IF USEFUL) Why were they useful?		X
(IF NOT USEFUL) Why weren't they useful to you?		X
Let's think back to last fall. I am going to read you a list. For each item on the list, please tell me how familiar you were with each of the following types of classroom activities.		X
First, think about the Science Fair. How familiar were you with this last fall? Would you say you were very familiar, somewhat familiar, or not very familiar? How about Creative Dramatics? (Continue with other programs)		
Now let's go through this list again. This time I would like for you to tell me how familiar you feel now about each of these topics. Let's start with... Science Fair. (Read program titles.)		X

Question Description	Wave		
	1	2	3
Now I'd like to ask you some questions about metrics. Most people find these questions difficult. Just give me your best guess if you are not sure of the answers.			
(ASK ALL RESPONDENTS)			
How many milliliters in a liter? (Circle Response) a) 10 b) 100 c) 1000 d) 10,000		X	
The boiling point in Centigrade degrees is (Circle Response) a) 0° b) 212° c) 32° d) 100°		X	
Metric weight or mass is measured in (Circle Response) a) liters b) grams c) meters d) stones		X	
A liter is equal to a cubic (Circle Response) a) meter b) decimeter c) kilogram d) milligram		X	
I am going to hand you a list of people who work at your school. Please go through the list and put an "x" by each person you discuss teaching ideas with at least once a week. If you do not discuss teaching ideas with a person, just leave the space blank and go on to the next name. (TURN PAGE AND HAND QUESTIONNAIRE AND PENCIL TO RESPONDENT.)	X	X	
Now please indicate people at your school who have especially good ideas about teaching.	X	X	

Appendix C

PERCEIVED PROGRAM SERVICES

Effects from telecommunication may be attitudinal, as well as behavioral. While the major part of our findings deals with classroom innovations, we also asked teachers viewing in-service whether they felt programs were useful. The question was phrased to emphasize the content rather than the form in which we delivered new teaching ideas.

Staffs in the two experimental conditions rated the services almost equally. The edge that emerged (insignificant based on school means) actually favored conventional, one-way delivery.

We probed further to learn if viewers had tried any of the classroom ideas or activities presented. About six out of ten said they had, and here we found a margin favoring interactive delivery. But again the difference was nominal.*

We also studied social interaction based on program content--had viewers talked with others about the things presented. The impact of telecommunication services can be passed along to occupational peer groups, in addition to being felt directly by viewers, and it is possible that system users perceive and can report processes leading to indirect effects. Again, however, we found no differences. In both one-way and interactive schools about six out of ten viewers described conversations with other teachers and principals stimulated by the programming we offered. Other teachers dominated as conversation partners.

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*Despite the fact that school averages for claims of using program content correlated ($r = .50$; $p = .005$, one-tailed) with general reports of having discovered new teaching ideas and methods during the past school year--from any source.

On these separate measures eliciting teachers' perceptions, the two modes of in-service delivery look comparable. And, although talking about program content and trying the ideas correlate, each is independent of evaluations of the programs as presentations.*

Thus, we find a sharp contrast between comparability in program judgments and consistent differences in potential for innovation that are detailed in the main part of this report.

Reasons for viewing and not viewing.

We asked open-end questions to elicit these explanations; again, the two treatment conditions are alike in responses to perceptual measures.

Approximately one-half of viewers described a general interest or curiosity about training to explain their decisions to watch. One out of four provided more detail about specific content interests--for example, in starting creative writing projects. One out of four said they watched because others had recommended the shows, and three out of ten described a miscellany of other reasons.

Rationalization for non-viewing is more clear-cut, if unrevealing. Eight out of ten said they simply had insufficient time.

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*Consistent with many findings about mass communication, people who discuss their media experiences turn out to be the same individuals who use the content. In this case building means for each variable are correlated at .59 ($p < .005$, one-tailed). This finding neither confirms nor contradicts the so-called "two-step flow" hypothesis, however.

Appendix D

CHANGES IN COMPLEMENTARITY BETWEEN PRINCIPALS AND TEACHERS IN INNOVATIVENESS

Throughout our study we have been reminded of the crucial role played by principals. They varied widely in enthusiasm when we first briefed them about project goals and procedures. The more dubious cloaked their feelings when higher administrators were present, but skepticism easily came to the surface during our visits to buildings.

Highly interested principals quickly thought of advantages to cable; the more reluctant dismissed in-service entirely as of no interest to their teachers who were "stuck in their ways" or "too tired to try something new."

We quickly discovered the obvious, we thought. Principals influence the morale of their staffs. They control rewards and punishments not covered in the teachers' union contract. They can encourage or inhibit teachers' willingness to try new ideas, even to view in-service on cable which was presented as a voluntary activity.

To our surprise (and relief), we discovered that urgings from principals to view had no impact on telecommunication effects. We searched more deeply, however, for the dynamics of teacher/principal relations that personal visits to buildings and casual observation could not prepare us to expect.

The ingredients of this evidence are simple and familiar.* We asked principals the same questions about having discovered new teaching ideas and methods the past year that were posed to their staffs. From all respondents we accepted any kind of idea, including administrative innovations. The relationship between each principal and his or her staff in idea richness bears scrutiny.

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*The following analysis was designed and executed by Eric Fredin, now on the faculty of Indiana University.

Naive psychology and our observations based on building visits forecast a positive correlation. Exciting principals filled with ideas should recognize and reward information seeking and its potential for innovation among their teachers. We should find principals who resist change surrounded by similar teachers--either because they imitate their building administrator or are not rewarded for trying something new.

Because we have post-experimental data at hand, this relationship can be examined as a potential outcome of different conditions of in-service availability. It is convenient to begin with control schools where we find an inverse relationship. The least innovative principals--six building administrators who could not think of a single new idea encountered in the past year--had teaching staffs who averaged more than the median number of ideas. The most innovative control principals, four persons with two ideas each, had staffs that averaged fewer than one idea per person, by and large.

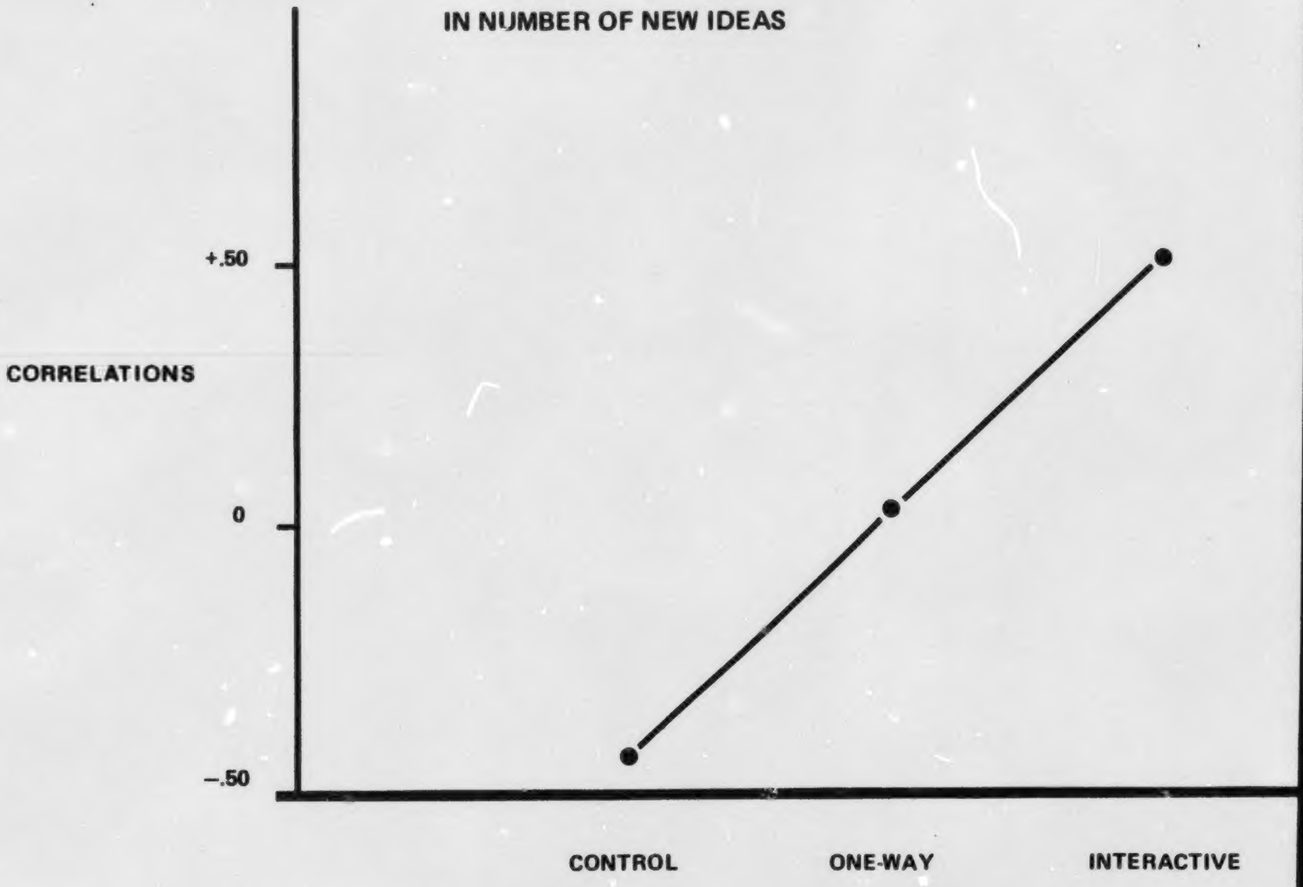
The correlation across 15 control schools is -.43 with a two-tailed probability of .11. The scatter plot shows a clear linear pattern.

Where only conventional in-service takes place, the data suggest a hydraulic, rather than imitative model of relationships between principals' and teachers' potential for doing their work in new and different ways. Principals who are most alert to innovations are surrounded by the most inert staffs. One could hypothesize that they have been assigned to these buildings in order to perk up teachers. But this explanation loses its plausibility when we turn to the two experimental conditions, one-way and interactive.

Here we see the relationship profoundly changed. In one-way schools there is no correlation, while among interactive schools principals and their teachers are alike to a degree that is nearly significant by statistical test.

FIGURE 1

CORRELATIONS BETWEEN PRINCIPALS AND TEACHERS IN NUMBER OF NEW IDEAS



	CONTROL	ONE-WAY	INTERACTIVE
COEFFICIENT	–.43	.18	.53
P VALUE (TWO-TAILED)	.11	.57	.06
N	15	12	13

The contrast between control and interactive buildings is underscored by dividing the scatter plots at the medians for each variable. In 13 of the 15 control schools teachers and their principals are opposite in potential for innovative behavior; either the principal reports many ideas and teachers few, or the reverse. In 11 of the 13 interactive schools teachers and their principals are alike in idea richness. One-way buildings are mixed as the near-zero correlation implies.

How are we to account for these results? Our spectulations hinge on the fact that in-service on cable originated from outside each building's social and professional environment. Program ideas and content were collegially approved, as our production system mandated, but by a relatively cosmopolitan, rather than parochial reference group. Peers from across the school system demonstrated ideas that our needs committee had judged important.

Programming provided teachers and their principal in each building an externally-originating stimulus toward which they could orient. Both parties could respond by sensing new teaching opportunities or by rejecting the communication service.

Staffs in control schools were caught in a more limiting situation that resembles the dynamics of role specialization. If the leader is forward-looking, it would seem his or her followers can afford to relax. If the leader lacks an appetite for innovation, followers pick up the slack. The arena for their behavior is prescribed by the total pool of teaching ideas circulating within each building's communication network, relatively undisturbed from outside.

We cannot be certain, of course, that the altered dynamic in innovative complementarity observed here would be repeated in other institutional settings using different programming strategies. But the marked shift in principal/

teacher correlations--moving from low, to medium, to high levels of in-service stimulation--raises interesting side effects that may result from the imposition of novel and intensive communication technologies.

Appendix E

DRAFT OF CONTRACTS FOR NEGOTIATED CONTINUATION OF INTERACTIVE CABLE SERVICES

The following draft agreements, as yet unconcluded, would establish access to the interactive system for the Rockford Fire Department. Rockford Schools and The University of Michigan would negotiate a parallel contract. The depreciated value of equipment listed in Attachment B would serve as the Schools' transfer to Cablevision in return for services charged according to rates set forth in MSU's agreement.

AGREEMENT BETWEEN THE CITY OF ROCKFORD, ILLINOIS FIRE DEPARTMENT AND ROCKFORD CABLEVISION, INC. FOR SERVICES ASSOCIATED WITH THE CONTINUATION OF INTERACTIVE TELEVISION TRAINING

In accordance with plans for continuation of interactive training described in the document titled "Agreement between Michigan State University, City of Rockford, Illinois Fire Department and Rockford Cablevision, Inc. for Continuation of Interactive Television Training Pursuant to the Experiment Funded by the National Science Foundation," Rockford Cablevision will provide additional services at the rates prescribed below:

1. Two-way system maintenance (distribution plant and headend equipment, except video), including weekly reading of COSs and return amps at headend ($400 per month) and equipment repair as needed at $22 per hour. Total for this item not to exceed $605.10 per month in any month system is in use for firefighter training.
2. Computer maintenance service on a per-call basis through General Automation--re-invoiced from Rockford Cablevision to the Rockford Fire Department without mark-up for costs associated with service to the Fire Department.
3. Headend videocassette recorder/player, character generator, monitors $110 per month. This equipment to be used exclusively for Fire Department services.

If two-way service is provided to users, other than the Rockford Fire Department, the other users will share the maintenance costs proportional to their use. The above rates will be renegotiated as each new user is added.

These rates will remain in effect until the completion of the agreement titled "Agreement between Michigan State University, City of Rockford, Illinois Fire Department and Rockford Cablevision, Inc. for Continuation of Interactive Television Training Pursuant to the Experiment Funded by the National Science

Foundation." At the completion of the agreement the Rockford Fire Department will be entitled to continue purchase of the services outlined in this agreement at similar rates.

AGREEMENT BETWEEN MICHIGAN STATE UNIVERSITY, CITY OF ROCKFORD, ILLINOIS FIRE DEPARTMENT AND ROCKFORD CABLEVISION, INC. FOR CONTINUATION OF INTERACTIVE TELEVISION TRAINING PURSUANT TO THE EXPERIMENT FUNDED BY THE NATIONAL SCIENCE FOUNDATION

All three parties to this agreement have a mutual interest in continuation of interactive television instruction for Rockford firefighters via the two-way television system developed through the National Science Foundation Grant No. APR75-14286. The initial experiment was a success from both technical and instructional perspectives. The system is now operational.

Plans for in-station two-way training and information exchange have been made by the Rockford Fire Department. The functions served by the two-way system, according to plans, would become integral to training and communication in the Department.

Rockford Cablevision is anxious to make maximum use of its two-way communication capability and enhance the value of cable service to the community. Rockford Cablevision is also interested in other services that might be developed and tested through the two-way system.

Michigan State University was committed to the goal of continued service in the original application for the grant:

> A final criterion (for selection of experimental opportunities) was our concern that whatever applications we might be able to implement within the cooperating community be ones which the community could itself continue to utilize and find satisfying, when the project ended.

Beyond fulfilling this original commitment, the University would like the opportunity to further evaluate the instructional system, and participate in a formal evaluation of other experiments to be conducted on the system.

To pursue these interests, the integrity of the system must be maintained. Therefore, by this agreement, the equipment identified in attachment A is transferred to Rockford Cablevision, Incorporated in return for the following services to the City of Rockford Fire Department valued at the rates indicated until, at these rates, the market value of the equipment, $25,197, (Attachment A) has been fully paid in services:

> Forward, midband channel to 12 fire stations, $20 per hour.
> Return channel from 12 fire stations, $20 per hour.
> Use of the forward and return channels for Fire Department training includes without charge the computer control of the videocassette programs, terminal scanning, response processing, feedback by character generator and report printouts as described in Volumes II and III of the "Michigan State University-Rockford Two-Way Cable Project" reports. This use also includes brief access to the computer and time code generator for preparation of two-way lessons.

The commitment for service is not to exceed five years from the date of this agreement, should the demand be so low as to extend the agreement over that much time. The agreement will be considered fulfilled at the time the market value of equipment has been fully paid in services, or five years after the date of this agreement.

At the end of the period where the services of Rockford Cablevision are subsidized by the transfer of equipment, the Rockford Fire Department will be entitled to purchase the services at negotiated rates approximating the rates in this agreement.

Through the service period under this agreement, Michigan State University will have access to technical, cost and firefighter performance data for analysis and publication in professional journals. Data necessary to evaluation of other experiments using any of the two-way equipment in Attachment A, conducted before the completion of the agreement will be made available to the University.

If the specified two-way services cannot be provided, for any reason, prior to the completion of this agreement, all of the equipment will revert to Michigan State University at no cost. The University will be obligated to pay the cost of removal. Rockford Cablevision, Inc. by this agreement does not accumulate equity in the equipment, through the period of the agreement. Transfer of ownership between Michigan State University and Rockford Cablevision is to be consummated at the completion of the agreement.

Attachment A

MICHIGAN STATE UNIVERSITY
NSF-ROCKFORD TWO-WAY EQUIPMENT

Item	
General Automation SPC 16/65 Minicomputer (32K), teletype, IO Controllers, Card Reader, Line printer	$ 12,825
Hazeltine 2000 CRT	1,259
1 Shintron Time Code Generator/Readers	1,750
Telemation Character Generator	1,905
2 Sharp Color Monitors	605
1 Sony Videocassette recorder	850
Time Code Interface (MSU)	1,332
Controller Interfaces (MSU)	699
Coaxial Scientific Transceiver and COS Addressor	2,234
19 Jerrold Terminals (CSC modified)	950
1 RCA CTM-10-B modulator	650
1 Band Pass Filter 3261-B	138
	$ 25,197

Attachment B

UNIVERSITY OF MICHIGAN
NSF-ROCKFORD TWO-WAY EQUIPMENT

	Item	Estimated Current Value
1.	General Automation SPC 16/65 Minicomputer, 34 K Core Memory	$ 3,496
2.	1 Shintron Time Code Generator Reader	1,750
3.	3M Character Generator	1,204
4.	1 SONY Videocassette Recorder	850
5.	1 RCA CTM-10 Modulator	656
6.	1 Band Pass Filter #3261	138
7.	11 Jerrold terminals	550
		$ 8,644

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Volume I -- Summary, Michigan State University-Rockford Two-Way Cable Project: System Design, Application Experiments and Public Policy Issues

Volume II -- Michigan State University-Rockford Two-Way Cable Project: System Design, Application Experiments and Public Policy Issues

Volume III -- Michigan State University-Rockford Two-Way Cable Project: Minicomputer System Software

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